

A revised taxonomic interpretation of *Gossypium* L. (Malvaceae)

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INTRODUCTION

Gossypium L. is a genus that has received considerable scientific attention over the years because of its agricultural importance as the source of the world's cotton crop, combined with its botanical interest as a highly diverse genus of global distribution. It has been the subject of study in many disciplines (e. g. Kohel & Lewis 1984; Mauney & Stewart 1986) and has been a model subject for evolutionary studies (e. g. Hutchinson, Silow & Stephens 1947; Fryxell 1965, 1971; Wendel & Albert 1992). All of this scientific study in various disciplines has needed a taxonomic underpinning to proceed, and a continuing series of such taxonomic work has been available, beginning with the monographic study of Todaro (1877) and including such major contributions as those of Watt (1907), Zaitzev (1928), Hutchinson (1947), Mauer (1954), and Fryxell (1979). The recent taxonomic interpretation presented by Dariev & Abdullaev (1985) is largely compilatory in nature, although two new subsections are proposed. The historical development of this taxonomic understanding of the genus was reviewed by Fryxell (1979, pp. 5-13).

Recent studies (notably by Volleson

1987; Holubec 1987, 1990; and Fryxell et al. 1992) have significantly enlarged our understanding of diversity in the genus *Gossypium*. At the same time, other recent studies in molecular biology of *Gossypium* have shed light on phylogenetic questions. For example, Wendel (1989) has shown that the New World tetraploid species contain cytoplasm of Old World diploid species; Wendel et al. (1991) have demonstrated the occurrence of homoploid reticulate evolution in certain species of *Gossypium* and a phylogeny based on cpDNA data of the entire genus has been presented by Wendel & Albert (1992). The present paper intends to evaluate this newer information and incorporate it into an integrated and updated account of the systematics of the genus. It also proposes to bring into a single account the "normal" apparatus of systematic studies, including keys, descriptions, synonymy typification, and other nomenclatural information. It is a curious fact that in spite of having received considerable attention and taxonomic study over many years, modern treatments of *Gossypium* have, in general, been incomplete, lacking one or more of the items listed. For example, Fryxell (1984) presented, for the first time, full and parallel description of all of the species

then known, but omitted keys and nomenclatural details, which had to be sought elsewhere in the literature. The present study includes information on almost a dozen species not dealt with in previous comprehensive studies, including recently described species and recently recognized (e. g. Fryxell et al. 1992; Vollesen 1987) and reinterpreted species (e. g. Vollesen 1987), and integrates this information into a single, unified account. The number of taxa in the genus is enlarged to fifty.

TAXONOMIC TREATMENT

Gossypium L., Sp. Pl. 693. 1753; Gen. Pl. ed. v. 309. 1754. - Lectotype: *Gossypium arboreum* L. (cf. Brizicky, 1967).

Xylon Miller, Gard. dict. abridg. ed. iv. 3. 1754.

Ingenhouzia de Candolle, Prodr. 1: 474. 1824. non *Ingenhoussia* Dennstedt, 1818.-Type: *Ingenhouzia triloba* de Candolle.

Sturtia R. Brown in Sturt, Exped. Cen. Austral. 2: app. 68. 1849. - Type: *Sturtia gossypoides* R. Brown.

Thurberia A. Gray, Mem. Amer. Acad. Arts n. s. 5 (Pl. Thurb.): 308. 1854.-Type: *Thurberia thespesioides* A. Gray.

Erioxylum Rose & Standley ex Rose, Contr. U. S. Natl. Herb. 13: 307. 1911.-Type: *Erioxylum aridum* Rose & Standley ex Rose.

Selera Ulbrich, Verh. Bot. Vereins Prov. Brandenburg 55: 50.-Type: *Selera gossypoides* Ulbrich.

Notoxylinon Lewton, J. Wash. Acad. Sci.

5: 305. 1915, pro parte.-Type: *Notoxylinon australe* (F. Muell.) Lewton.

Neogossypium Wouters (pro sect.) ex Roberty, Coton Fibers Trop. 4: 89. 1949.-Type: not stated.

Shrubs or subshrubs, erect or decumbent to prostrate, or small to medium-sized trees, usually more or less punctate throughout. Foliage glaucous or glabrate to puberulent or hirsute. Leaves ovate-cordate, usually entire (serrate in one species), acuminate, shallowly lobulate, or deeply palmately 3-7-lobed (fully trifoliate in one species), palmately or pedately 3-7-nerved. Foliar nectaries 1-5, located abaxially on principal nerves, rarely absent, colorless or bright red, basally or distally placed, sometimes elongated. Petioles terete or quadrangular. Stipules filiform, subulate, or falcate, persistent or caducous. Flowers borne singly or clustered on axillary pedicels or severally on sympodially branching lateral inflorescences. Pedicels usually surmounted by trimerous involueller nectaries. Involucel of 3 bracts inserted above the nectaries. Bracts usually distinct, filiform to subulate to broadly cordate, much shorter than calyx to nearly equaling corolla and enclosing fruit, entire, dentate, or lacinate, usually persistent in fruit but sometimes caducous at anthesis. Calyx truncate, 5-toothed, or deeply 5-lobed, often prominently punctate. Petals often large and showy, white, cream, yellow, rose or mauve, usually with a maroon spot on claw (spot sometimes reduced or completely absent), usually pubescent without, glabrous within. Staminal column usually glabrous and pallid but sometimes darkly pigmented (by extension of petal spot), punctate or epunctate, antheriferous

throughout length or only in upper half; pollen yellow or cream coloured. Style and stigma usually long and slender (often greatly exceeding androecium, but sometimes shorter), clavate; style undivided, pallid, often punctate; sometimes epunctate, stigmatic surfaces decurrent, 3-5-lobed. Capsule 3-5-lobed, glabrous or sometimes pubescent, chartaceous, coriaceous, or ligneous, often prominently punctate, dehiscent and opening slightly or flaring widely.

Seeds one to several per locule, usually free but sometimes more or less coherent into a single unit for each locule; usually comose, sometimes minutely puberulent or glabrous, turbinate, sometimes angularly so, 4-12 mm long; seed hairs white to various shades of brown, copious, 1-3 cm long, usually crimped but patent in two species. Embryos with conduplicate cotyledons, punctate or epunctate. Chromosome numbers: $2n = 26, 52$.

Synopsis of generic classification:

GOSSYPIMUM

Subgenus **Sturtia** (R. Brown) Todaro

Section **Sturtia**. (Included species: *G. nandewarens*, *G. robinsonii*, *G. sturtianum*)

Section **Grandicalyx** (Fryx.) Fryx. (Included species: *G. costulatum*, *G. cunninghamii*, *G. enthyle*, *G. exiguum*, *G. londonderriense*, *G. marchantii*, *G. nobile*, *G. pilosum*, *G. populifolium*, *G. pulchellum*, *G. rotundifolium*)

Section **Hibiscoidea** Todaro. (Included species: *G. australe*, *G. bickii*, *G. nelsonii*)

Subgenus **Houzingenia** Fryx.

Section **Houzingenia** (Included species: *G. thurberi*, *G. trilobum*)

Subsection **Integrifolia** (Todaro) Todaro (Included species: *G. davidsonii*, *G. klotzschianum*)

Subsection **Caducibracteolata** Mauer (Included species: *G. armourianum*, *G. harknessii*, *G. turneri*)

Section **Erioxylum** (Rose & Standl.) Prokh.

Subsection **Selera** (Ulbrich) Fryx (Included species: *G. gossypioides*)

Subsection **Erioxylum** (Rose & Standl.) Fryx. (Included species: *G. aridum*, *G. laxum*, *G. lobatum*, *G. schwendimanii*)

Subsection **Austroamericana** Fryx. (Included species: *G. raimondii*)

Subgenus **Gossypium**

Section **Gossypium**

Subsection **Gossypium** (Included species: *G. arboreum*, *G. herbaceum*)

Subsection **Anomala** Todaro (Included species: *G. anomalum* subsp. *anomalum*, *G. anomalum* subsp. *senarens*, *G. capitis-viridis*)

Subsection **Pseudopambak** (Prokh.) Fryx. stat. nov. (Included species: *G. areysianum*, *G. benadirens*, *G. bricchettii*, *G. incanum*, *G. somalense*, *G. stocksii*, *G. vollesenii*)

Subsection **Longiloba** Fryx. (Included species: *G. longicalyx*)

Section **Triphylla** (Prokhanov) Fryx. (Included species: *G. triphyllum*)

Section **Serrata** Fryx., sect. nov. (Included species: *G. trifurcatum*)

Subgenus **Karpas** Rafinesque (Included species: *G. barbadense*, *G. darwinii*, *G. hirsutum*, *G. mustelinum*, *G. tomentosum*).

Synoptic key to the species of *Gossypium*

1. Embryos with no (or very few) gossypol glands; corolla white (often fading pink) or mauve; plants erect, decumbent, or prostrate, subshrubs or shrubs; non-cultivated Australian plants (subgenus **Sturtia**).
 2. Erect shrubs; herbage odoriferous when crushed, glaucous, with raised black tubercles on stems and petioles, bracts of the involucre broadly cordate to narrowly triangular, exceeding calyx; calyx truncate to short-toothed; petals mauve; cotyledons obcordate (sometimes nearly bifid) (Section **Sturtia**).
 3. Leaves deeply 3-5-lobed, the lobes ovate-lanceolate, acuminate; foliar nectaries 3-5, often red, prominent, distal; bracts of the involucre triangular to linear-lanceolate (rarely ovate-lanceolate), entire; seeds 4-6 mm long; little-branched shrubs, taller than broad.....1. **G. robinsonii**
 3. Leaves simple or moderately 3-lobed; foliar nectaries 1-3, obscure; basal; bracts of the involucre ovate to broadly cordate; seeds 3-4 mm long; much-branched shrubs, as broad as tall.
 4. Leaves simple, often adaxially folded or rolled; bracts of the involucre ovate, entire (rarely lacinate); seed hairs whitish.....2. **G. sturtianum**
 4. Leaves flat, usually 3-lobed, with auriculate appendages at base; lobes rounded, apiculate; bracts of the involucre broadly cordate, entire or 3-5-dentate; seed hairs brownish.....2. **G. nandewarens**
2. Erect, decumbent, or prostrate subshrubs; herbage non-odoriferous, glabrate to puberulent or pubescent, punctate but lacking raised tubercles on stems and petioles; bracts of the involucre filiform to linear-subulate or ligulate, usually shorter than the calyx; calyx 5-lobed; petals white or mauve; cotyledons obtuse or emarginate.
 5. Erect, decumbent, or prostrate herbs or subshrubs; herbage finely tomentulose or pilose or glabrate; leaves unlobed; peduncles often uniflorate 1-8 cm long, often recurved in fruit; bracts of the involucre often re-

flexed, usually ligulate; calyx lobes often long and broadly foliaceous (sometimes narrowly acuminate); capsules glabrous, 3-loculed; seeds arillate, minutely puberulent (seemingly glabrous) (section **Grandicalyx**).

6. Leaves sessile, basally cuneate, penninerved; stems glabrous.....
.....4. **G. cunninghamii**.
6. Leaves manifestly petiolate (petioles 1/4-1 times length of blade), broadly ovate or subrotund to ovate (if rarely elliptic, then stems finely puberulent), usually palminerved, basally truncate to deeply cordate; stems glabrous to variously puberulent or pubescent.
7. Plants prostrate, the pedicels generally at more or less right angles to the stem.
 8. Stems minutely pubescent (rarely glabrate), the hairs simple, erect, 0.1-0.3(-1) mm long; foliar nectary at base of midrib or somewhat displaced on to petiole; stipules 4-6 mm long; calyx glabrate.....12. **G. rotundifolium**.
 8. Stems glabrous to hirsute, the hairs (if present) simple, ca. 1 mm long; foliar nectary 2-4 mm distant from petiole; stipules 6-11 mm long; calyx glabrous or sparsely pilose, the hairs 1 mm long.....13. **G. exiguum**.
7. Plants suberect (ascending or reclining) to erect, the pedicels at acute angles to the stem.
 9. Plants erect, the foliage finely puberulent or glabrate; involuellar nectaries present; foliar nectaries sometimes elongate (i.e. more than 4 mm long); calyxes 0.6-2.2 cm long.
 10. Foliage glabrate; calyx 0.6-1.2 cm long.....
.....8. **G. enthyale**.
 10. Foliage finely puberulent; calyx 1.2-2.2 cm long.
 11. Petals 3.5-4 cm long, with gossypol glands evenly distributed throughout petals; androecium pallid; leaves palmately nerved; foliar nectaries 1-2.5 mm long, located on midrib 4-9 mm distant from petiole; stipules 4-6 mm long; sinuses between calyx lobes subacute....7. **G. pulchellum**.
 11. Petals 4.4-5 cm long, with gossypol glands confined to the external margin; androecium purplish; leaves tending toward penninerved; foliar nectaries 4-22 mm long, located on midrib

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- 9-20 mm distant from petiole; stipules 8-10 mm long; sinuses between calyx lobes broadly rounded.....6. *G. nobile*.
9. Plants reclining, ascending, or sub erect, often multi-stemmed, the foliage minutely pubescent, pilose, or glabrous; involucellar nectaries present or absent; foliar nectaries usually less than 4 mm long; calyces 0.9-3.4 mm long.
12. Stems and calyces minutely pubescent; anthers reddish (the staminal column pallid); petal glands few or many.
13. Involucellar nectaries absent; pedicel articulated at or near base; foliar nectaries 2-6 (-18) mm long; gossypol glands in petals obscure but uniformly distributed; leaf blades deeply cordate.....11. *G. londonderriense*.
13. Involucellar nectaries present; pedicels articulated 5-15 mm below flower; foliar nectaries 1-2 mm long; gossypol glands in petals few, confined to auricle; leaf blades subtruncate to cordate.....9. *G. marchantii*.
12. Stems and calyces puberulent, pilose, or glabrous; anthers and staminal column pallid; petal glands few, marginally distributed, or none.
14. Petioles ca. 1/4 length of blade, the blade more or less truncate basally; pedicel articulated at or near base; calyx lobes broadly foliaceous, the sinuses more or less acute.....9. *G. costulatum*.
14. Petioles 1/2-1 times length of blade, the blade cordate to deeply cordate basally; pedicels articulated 1-3 cm below the flower [?]; calyx lobes narrowly acuminate, the sinuses broadly rounded.
15. Involucellar nectaries usually absent; stems and calyces usually more or less pilose (rarely glabrate); calyx 1.8-3.4 cm long.14. *G. pilosum*.
15. Involucellar nectaries present; stems and

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calyces glabrous; calyx 0.9-1.8 cm long.

.....10. *G. populifolium*

5. Erect subshrubs; foliage finely puberulent to coarsely stellate-pubescent; leaves unlobed, lobed, or deeply parted; foliar nectary red or colorless, sometimes prominent; inflorescences often multiflorate, sympodial; cleistogamy common; pedicels 1-2 cm long; bracts of the involucre erect, linear to filiform, subequal to calyx; calyx lobes narrowly acuminate; capsules puberulent or glabrous, 3-5-loculed; seeds exarillate, comose (section *Hibiscoidea*)

16. Capsule puberulent; herbage finely puberulent; calyx tube constricted basally; gossypol glands of the calyx few, more frequent on distal margin.....15. *G. australe*

16. Capsules glabrous or nearly so, prominently punctate; herbage coarsely pubescent; calyx tube rounded basally; gossypol glands of the calyx uniformly distributed.

17. Calyx 6-12 mm long; seed hairs straight, patent; capsule depressed-apiculate; the beak 0.5-2 mm long.....16. *G. nelsonii*

17. Calyx 18-24 mm long; seed hairs crimped, appressed; capsule ovoid, the beak 3-5 mm long.....17. *G. bickii*

1. Embryos with prominent gossypol glands (often black, sometimes reddish, or even translucent yellow, but always prominent); corolla cream, yellow, or rose; erect shrubs or trees (rarely decumbent or scandent subshrubs, but then corolla yellow).

18. Relatively robust shrubs or trees (sometimes smaller shrubs) bearing no commercial cotton fibers; bracts of the involucre entire or sometimes lacinate; seeds comose or subglabrous; wild species of the New World (subgenus *Houzingenia*)

19. Small to large shrubs; petals cream or yellow, 1.5-4.5 cm long, with small petal spot (sometimes absent); capsules subglobose or oblong; seeds subglabrous or with seed hairs tightly appressed (section *Houzingenia*)

20. Seeds 3-6 mm long, subglabrous; inflorescences sympodial, petal spot small, sometimes vestigial or absent; involucre persistent in fruit.

21. Petals cream to pale yellow; seeds 3-5 mm long; leaves deeply 3-5-lobed; bracts of the involucre usually entire (if toothed, then ligulate); foliage glabrate; capsules

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mostly 3-celled; stems 5-angled or 5-ridged (subsection **Houzingenia**).

22. Bracts of the involucre ovate-cordate, entire; shrubs to 6 m tall; stipule falcate, 7-10 mm long; calyx irregularly 5-10-toothed, petals 2-3 cm long, pale yellow; capsules 15-18 mm long...18. **G. trilobum**.
22. Bracts of the involucre ligulate, entire or rarely few-toothed at apex; shrubs to 4 m tall; stipules linear-subulate, 5-7 mm long; calyx truncate; petals 1.5-2.5 cm long, cream-colored; capsules 10-15 mm long.15. **G. thurberi**.
21. Petals yellow; seeds 5-6 mm long; leaves unlobed or shallowly lobulate; bracts of the involucre laciniate or dentate, cordate; foliage softly tomentose (rarely glabrate); capsules 4-5-celled; stems terete (subsection **Integrifolia**).
23. Shrubs to 4 m tall; petals strongly plicate; 3-4 cm long with essentially no petal spot, leaves unlobed; seeds free; bracts of the involucre 11-17-laciniate21. **G. klotzschianum**.
23. Shrubs 0.5-1.5 m tall; petals weakly plicate, 2-3 cm long, with variably developed small dark spot at base (rarely absent); leaves unlobed or 3-lobulate; seeds often connate within the locule; bracts of the involucre 7-11-laciniate.....20. **G. davidsonii**.
20. Seeds 8-10 mm long, with tightly appressed seed hairs; flower axillary; petal spot small but well marked; involucre caducous at or before anthesis; leaves glabrate, unlobed or shallowly lobed (subsection **Caducibracteolata**).
24. Peduncle 2-7 cm long with small petiolate leaf at submedian articulation; bracts of the involucre linear, 1-3 mm wide, caducous in bud; leaves unlobed; seed hairs brownish.....23. **G. armourianum**.
24. Peduncle 0.5-2 cm long, with subulate caducous bract at submedian articulation; bracts of the involucre lanceolate to ovate, 4-9 mm wide, caducous at anthesis; leaves shallowly 3-lobed.

- 25. Bracts of the involucl lanceolate, entire, 4-7 mm wide; staminal column 7-8 mm long, the filaments 2-3 mm long; carpel walls 1-1.5 mm thick; peduncles 0.5-1.5 cm long, gossypol glands on upper leaf surface obscure; seed hairs whitish.....22. **G. harknessii**
- 25. Bracts of the involucl ovate, 3-7-laciniate, 7-9 mm wide; staminal column 16-17 mm long, the filaments 5-6 mm long; carpel walls 0.5 mm thick; peduncles ca. 2 cm long; gossypol glands on upper leaf surface manifest; seed hairs brownish.....24. **G. turneri**
- 19. Large shrubs or trees; petals various shades of rose, 3-8 cm long, with large petal spot (covering lower third or half of petal); capsules ovoid-elongate; seeds comose (section **Erioxylum**)
- 26. Trees, usually with a single trunk; flowers axillary (sometimes fasciculate), mostly appearing after leaves are shed; bracts of the involucl triangular-subulate, much shorter than calyx (sub-section **Erioxylum**)
- 27. Leaves spirally arranged, palmately or pedately nerved; calyx subtruncate or shallowly (1-3 mm) toothed; flowers usually solitary (or paired) in the leaf axils; seeds 4-12 mm long, the seed hairs grayish or brownish.
- 28. Leaves deeply cordate, usually 3-lobed, pedately 7-nerved; capsules 3-4 cm long, 3-5-loculed; calyx 8-10 mm long; petals 5-8 cm long; seeds 6-8 mm long29. **G. laxum**
- 28. Leaves cordate to truncate, usually unlobed, palmately 5-7-nerved; capsules 2-2.5 cm long, 3(-4)-loculed; calyx 5-9 mm long; petals 3.5-5 cm long; seeds 4-12 mm long.
- 29. Calyx and pedicel glabrous; calyx 5-7 mm long; involucellar bracts entire or obscurely 2-3-toothed; seeds 10-12 mm long with grayish hairs; leaves subglabrous, broadly ovate, usually cordate.....27. **G. schwendimanii**
- 29. Calyx and pedicel farinose-puberulent; calyx 6-9 mm long; involucellar bracts entire; seeds 4-6 mm long with brownish hairs; leaves minu-

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- tely pubescent, usually narrowly ovate, truncate26. **G. aridum**
- 27. Leaves distichous, pedately-veined, 3-lobed; calyx 5-lobed (lobes 6-10 mm long); flowers usually in axillary fascicles; seeds 10-11 mm long, the seed hairs grayish.....28. **G. lobatum**
- 26. Large subarborescent shrubs usually with multiple trunks; inflorescences sympodial, the flowers appearing when the plants are in full foliage; bracts of the involucre ovate-cordate, enclosing the bud and greatly surpassing it; staminal column often pigmented.
- 30. Bracts of the involucre entire, marginally connate in bud through interlocking hairs; leaves deeply 3-lobed; foliar and involucellar nectaries lacking; anther mass columnar (subsection **Selera**).25. **G. gossypoides**
- 30. Bracts of the involucre deeply lacinate or fimbriate, free; leaves unlobed; cordate; foliar and involucellar nectaries present; anther mass globose to ellipsoid (subsection **Austroamericana**).....30. **G. raimondii**
- 18. Relatively small shrubs or subshrubs (or if arborescent, then bearing cotton); bracts of the involucre commonly incised. sometimes entire; seeds variously comose, sometimes producing commercial cotton.
- 31. Leaves unlobed or lobed (sometimes deeply parted), the lobes commonly narrowed at their base, obtuse or acuminate; bracts of the involucre linear to cordate entire or variously incised, free or sometimes connate basally; flowers and fruits erect or pendent; seeds comose, bearing short hairs or commercial cotton; wild species or diploid cultigens of the Old World (subgenus **Gossypium**)
- 32. Erect shrubs or subshrubs, some in cultivation for seed fibers; leaves 3-7-lobed (or trifoliolate in *G. triphyllum*); the lobes rounded (except very narrow in certain cultigens); seeds comose, bearing short hairs or commercial cotton (section **Gossypium**)
- 33. Cultigens, bearing cotton; bracts of the involucre ovate-cordate, entire or incised; capsules smooth (subsection **Gossypium**)
- 34. Bracts entire or few-lacinate, enclosing bud,

- sometimes basally connate; capsules elongated, flaring widely, releasing cotton; corolla color variable.
.....31. **G. arboreum**
34. Bracts 5-13-dentate, often flaring, usually free; capsules subglobose, not flaring on dehiscence (cotton removed with difficulty); corolla yellow.....
.....32. **G. herbaceum**
33. Wild plants, bearing no cotton; bracts of the involucre linear, often more or less divided or toothed apically.
35. Leaf blades ovate, serrate, the veins terminating in the teeth; bracts of the involucre deeply trifid (section **Serrata**).....45. **G. trifurcatum**
35. Leaf blades manifestly 3-5-lobed or trifoliate, the margin entire, the veins not terminating at the margin; bracts of the involucre entire or apically 3-toothed.
36. Leaves trifoliate, the leaflets narrowly elliptic; fruits densely pubescent; corolla pale yellow suffused with lavender, with a dark centre (section **Triphylla**).....44. **G. triphyllum**
36. Leaves 3-5-lobbed; fruits glabrous, verrucose; corolla bright yellow with a dark centre (section **Anomala**)
37. Involucellar bracts 3-toothed or deeply trifid; leaves deeply 5-7-lobed, the central lobe often secondarily lobed; calyx abscising circumscissally at base; capsules 3-5-loculed.....35. **G. capitis-viridis**
37. Involucellar bracts entire or obscurely 3-toothed at apex; leaves moderately 3-5-lobed, the lobes simple; calyx persistent; capsules 3-loculed.
38. Young branches and petioles with long, spreading simple hairs.....
33. **G. anomalum** subsp. **senarense**
38. Young branches and petioles lacking long, spreading hairs or, if present, long hairs stellate.....
33. **G. anomalum** subsp. **anomalum**

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33. Erect, decumbent or scandent shrubs or subshrubs, none cultivated; leaves simple or lobed; seeds comose but bearing no commercial cotton (section **Pseudopambak**)
 39. Bracts of the involucler linear to cordate, more or less incised (if entire, petal spot absent); leaves simple or lobed; petal spot usually manifest; calyx lobes equaling tube or obsolete; plants erect to decumbent, in arid zones; flowers sometimes pendent (subsection **Pseudopambak**)
 40. Plants decumbent; leaves deeply lobed; involucellar bracts ovate-laciniate, the teeth longer than wide.....36. **G. stocksii**
 40. Plants erect; leaves unlobed or shallowly lobed; bracts of the involucler ovate to narrowly lanceolate, the teeth (when present) about as long as wide.
 41. Bracts of the involucler narrowly lanceolate (3-4 times as long as wide), subentire.....
.....37. **G. areysianum**
 41. Bracts of the involucler ovate to ovate-cordate (1-2 times as long as wide), entire, toothed or laciniate.
 42. Capsules 3-4-loculed, glabrous to sparsely strigose, acute or apiculate; main veins of involucellar bracts terminating at margin.
 43. Capsules pubescent, 13-15- mm long, with 2 seeds per locule; epunctate, 4-6- mm long, with 5 unequal teeth; petal epunctate; leaves pedately veined....
.....42. **G. vollesenii**
 43. Capsules glabrous, up to 11 mm long, with 1 seed per locule; calyx punctate.
 44. Calyx 9-10 mm long, with distinct triangular teeth;

- petals punctate; leaves palmately veined.....
.....41. *G. incanum*
44. Calyx 5-7 mm long, the margin subtruncate or undulate; petals epunctate; leaves pedately veined....
.....38. *G. somalense*
42. Capsules 5-loculed, densely strigose, cuspidate; calyx and involucl not punctate; all (or at least lower) veins of the involucellar bracts anastomosing; calyx margin undulate.
45. Involucel bracts laciniate, the apical veins terminating in the teeth.....39. *G. bricchettii*
45. Involucellar bracts entire or subentire, all veins anastomosing...
.....40. *G. benadirens*
39. Bracts of the involucl ovate-cordate, entire; leaves unlobed, cordate-acuminate; corolla bright yellow without dark centre; calyx lobes longer than the tube; plants scandent (subsection *Longiloba*).....
.....43. *G. longicalyx*
32. Leaves lobed (rarely deeply parted), the lobes acuminate, commonly broadest at base; bracts of the involucl cordate, laciniate, free; flowers and fruits erect; seeds often bearing commercial cotton; New World tetraploids, mostly cultigens, cosmopolitan in cultivation (subgenus *Karpas*)
46. Petals bright yellow, lustrous, lacking dark petal spot; foliar and involucellar nectaries absent; foliage minutely grayish puberulent; seed hairs red-brown, not commercially usable; involucl less than 2 cm long
.....47. *G. tomentosum*
46. Petals cream to yellow, dull-surfaced; petal spot often present; foliar nectaries present and involucellar nectaries usually present; foliage densely pubescent

Interpretation of *Gossypium*

(rarely puberulent) to glabrate; seed hairs white to various shades of brown, usually providing commercial cotton; involuellar bracts mostly more than 2 cm long.

47. Capsules 3-5-loculed, ovoid or subglobose (rarely elongate), smooth; calyx truncate or with acute lobes or long-acuminate teeth, usually less than 6 mm long (excluding teeth); stipules 0.5-1.5 cm long (rarely to 2 cm); leaves 3-5-lobed, the central lobe triangular to ovate, usually 1-1.5 times as long as wide; bracts of the involucl 3-19-lacinate, the teeth triangular and acute or lanceolate and acuminate in distal portion, separated by more or less acute sinuses50. **G. hirsutum**

47. Capsules usually 3-loculed, narrowly ovoid, more or less elongate, pitted; calyx usually truncate, to 10 mm long; stipules 1-5 cm long; leaves 3-7-lobed, the central lobe ovate to lanceolate, usually more than 1.5 times as long as wide; bracts of the involucl 5-17-lacinate, the teeth acuminate from the base, separated by rounded sinuses.

48. Plants mostly cultivated, with large capsules (3.5-6 cm long) and copious white (sometimes tan) seed hairs (cotton).....
.....48. **G. barbadense**

48. Plants wild, with small capsules (less than 3 cm long) and relatively sparse seed hairs (usually tan or brown, sometimes white).

49. Leaves usually ca. half-divided; from northeastern Brazil.....
.....46. **G. mustelinum**

49. Leaves usually more than half-divided; from the Galapagos Archipelago.....
.....49. **G. darwinii**

Subgenus **Sturtia** (R. Brown) Todaro, Giorn. R. Ist. Incoragg. Agric. Arti Manifatture Sicil. 1: 35. 1863.

Type: *Sturtia gossypoides* R. Brown
[= *Gossypium sturtianum* J. H. Willis].

Section **Sturtia**

Erect shrubs with glaucous foliage that is odoriferous when crushed; stems with raised black tubercles (gossypol glands); leaves lobed or unlobed, the margins entire; involucellar bracts ovate to lanceolate, usually entire, persistent; corolla mauve with dark center; seeds exarillate, appressed-pubescent.

Members of section *Sturtia* characteristically occur in desert situations in interior Australia. They often show a preference for seasonally dry stream courses. *Gossypium nandewarensense* grows in relatively more mesic habitats than the other two species.

1. ***Gossypium robinsonii*** F. Mueller, Fragm. 9: 126. 1875.

Hibiscus robinsonii (F. Mueller) Kuntze, Revis. Gen. Pl. 1: 69. 1891.

Cienfuegosia robinsonii (F. Mueller) Hochreutiner, Annuaire Conserv. Jard. Bot. Geneve 6: 57. 1902.

Notoxylum robinsonii (F. Mueller) Lewton, J. Wash. Acad. Sci. 5: 307. 1915.

Gossypium sturtii F. Mueller subsp. *robinsonii* (F. Mueller) Roberty, Candollea 13: 24. 1950.

Type: Australia. Western Australia, Port Walcott, Harper 6 (holotype: MEL).

Gossypium walchottianum Todaro, Relaz. Cult. Coton. 119. 1877.

Type: Australia. Western Australia, Dampier's Archipelago, Walcott s. n. (holotype: MEL).

Erect shrubs 2 m tall, the stems glabrous, punctate, the glands slightly raised. Leaves petiolate, truncate or subcordate, deeply 5-lobed, entire, palmately 5-7-nerved, glabrous, punctate, the lobes narrowly lanceolate, acuminate, with a prominent, often reddish foliar nectary on principal nerve of each lobe, medially to distally placed; stipules falcate, acuminate, 15-18 mm long, ca. 1.5 mm wide, caducous. Inflorescences sympodial, the pedicels glabrous, punctate, 10-20 mm long, surmounted by 3 involucellar nectaries; bracts of the involucre lanceolate, entire, acuminate, 15-20 mm long, 3-10 mm wide, glabrous, punctate; calyx 8-12 mm long, glabrous, punctate, about half-divided into 5 caudate lobes; petals 3.5-5 cm long, mauve with small dark red spot at base, punctate on margin where exposed in bud, otherwise epunctate; staminal column ca. 1 cm long, more or less purplish, glabrous, epunctate, the filaments 2 mm long, the anther mass columnar, the pollen orange; style exceeding the androecium, pallid, epunctate. Capsule 4-loculed, ovoid, 20 mm long, glabrous, prominently punctate; seeds several per locule, 6-7 mm long, densely pubescent; the fibres appressed, grayish.

Distribution. Western Australia, in the Hamersley Range and adjacent lowlands: (see map in Anonymous 1968, fig. 2).

Illustrations. Saunders (1961, Pl. 4); Fryxell (1979, fig. 18); Vallcek (1979, figs. 16, 17); Dariev & Abdullaev (1985, fig. 28).

2. *Gossypium sturtianum* J. H. Willis, Vict. Natur. 64: 9. 1947, based on *Sturtia gossypioides* R. Brown in Sturt, Exp. Cent. Austral. 2: app. 68. 1849.

Gossypium sturtii F. Mueller, Fragm. 3: 6. [Apr] 1863.

Gossypium australiense Todaro, Giorn. R. Ist. Incoragg. Agric. Arti. Manifatture Sicil. 1: 35. [Nov] 1863.

Hibiscus gossypioides (R. Brown) Kuntze, Revis. Gen. Pl. 1: 69. 1891.

Cienfuegosia gossypioides (R. Brown) Hochreutiner, Annuaire Conserv. Jard. Bot. Geneve 6: 56. 1902.

Gossypium gossypioides (R. Brown) C. A. Gardner, Enum. Pl. Austral. Occid. 79 1930 (non *Gossypium gossypioides* (Ulbr.) Standley, 1923).

Type: Australia. Queensland, in the beds of the creeks of the Barrier Range, *Sturt 20* (holotype: BM).

Widely branching shrubs 1-2 tall; the stems glabrous, prominently punctate, the glands raised. Leaves petiolate, basally truncate or subcordate, unlobed or rarely lobed, ovate-elliptic to subrotund, longer than broad, entire, palmately 5(-7)-nerved, glabrous and punctate above and beneath, obtuse to acute, apiculate, with a foliar nectary 1-2 mm long on midrib beneath; stipules falcate, 5-9 mm long, 1-1.5 mm wide, caducous. Flowers and fruits borne on sympodial inflorescences; the pedicels 1-2 cm long, glabrous with raised glands, surmounted by 3 reddish involucellar nectaries; bracts of the involucre inserted above the nectaries, lanceolate-ovate, 18-22 mm long, 9-12 mm wide, entire, acute to acuminate,

glabrous, punctate; calyx 8-9 mm long, prominently punctate, glabrous, shallowly 5-toothed, the lobes acuminate; petals 3.5-4.5 cm long, mauve with dark maroon spot at base within, ciliate on claw, pubescent externally where exposed in bud, otherwise glabrous, epunctate or with glands along exposed margin; staminal column pallid, glabrous, epunctate, ca. 20 mm long, the filaments uniformly 1-1.5 mm long, the anthers pinkish, the anther mass columnar, the pollen yellow-orange; style exceeding the androecium, sparsely punctate. Capsules ovoid, 2 cm long, 5-loculed, glabrous, prominently punctate; seeds 4-5 mm long, densely pubescent, the fibres brownish, appressed.

Distribution. Central Australia (see map in Anonymous 1968, fig. 2).

Illustrations. Watt (1907), fig. 2; Saunders (1961, pl. 3), reprined by Fryxell (1979, fig. 16); Dariev & Abdullaev (1985, fig. 26).

A color photograph of this species, giving a faithful rendition of corolla color, is presented in the frontispiece ("Floral emblems of Australia and its states") of Flora of Australia, Introduction (vol. 1, 1981). *Gossypium sturtianum* is the floral emblem of the Northern Territory.

3. *Gossypium nandewarensense* Derera, Empire Cotton Growing Rev. 41: 14. 1964.

Gossypium sturtianum var. *nandewarensense* (Derera) Fryxell, Bot. Gaz. 125: 108. 1964.

Type: Australia. New South Wales, Nandewar Ranges, Deriah Forest, 18 Jan 1961, *Derera s. n.* (holotype: NSW).

Widely branching shrubs 1-2 m tall, the stems glabrous, prominently punctate, the glands raised. Leaves petiolate, basally truncate to subcordate with 2 basal auriculate appendages, simple or 3-lobed, broader than long, entire, palmately 5(-7)-nerved, glabrous and punctate above and beneath, the lobes rounded-apiculate, with an elongate foliar nectary 2-2.5 mm long on midrib beneath; stipules falcate, 6-12 mm long, 1-2 mm wide, caducous. Flowers and fruits borne on sympodial inflorescences; pedicels 1-2 cm long, glabrous, with raised glands, surmounted by 3 prominent reddish involuellar nectaries; bracts of the involucler inserted above the nectaries, broadly cordate-ovate, 18-20 mm wide, entire or obscurely toothed apically, glabrous, punctate; calyx 7-8 mm long, prominently punctate, glabrous, shallowly 5-lobed, the lobes apiculate; petals 4.5-5.5 cm long, mauve with dark maroon spot at base within, densely ciliate on claw, pubescent externally where exposed in bud, glands sparse to absent elsewhere; staminal column pallid, glabrous, epunctate, ca. 15 mm long, the filaments uniformly 1 mm long, the anthers pinkish, the anther mass columnar, the pollen yellow-orange, style exceeding the androecium, epunctate. Capsules ovoid, 2 cm long, 5-loculed, glabrous, with prominent raised glands; seeds 4-5 mm long, densely pubescent, the fibres grayish, appressed.

Distribution. Eastern Australia, in Queensland and New South Wales (see map in Anonymous 1968, fig. 2)

Illustrations. Fryxell (1979, fig. 17); Valicek (1979, figs. 13, 14); Dariev & Abdullaev (1985, fig. 27).

As indicated in the synonymy, I have

formerly (e.g. Fryxell 1979, 1984) treated this taxon in varietal rank. On fuller consideration of diversity in the genus *Gossypium* in general and in subgenus *Sturtia* in particular, I find no compelling reason for retaining it at this rank and therefore restore it to specific rank in the present interpretation.

Subgenus *Sturtia*

Section **Grandicalyx** (Fryxell) Fryxell
Nat. Hist. Cotton Tribe 52.—1979.

Type: *Gossypium costulatum* Todaro.

Erect, reclining, or prostrate shrubs or subshrubs with glabrous to pubescent foliage; stems punctate, not tuberculate, leaves unlobed, the margins entire; involuellar bracts ligulate, usually entire, reflexed, persistent; corolla white (fading pink) with dark centre; seeds subglabrous, arillate.

The eleven species of section *Grandicalyx* occur in the Kimberley Region of northwestern Australia, with the exception of *G. cunninghamii*, which is found on the Cobourg Peninsula of northernmost Australia. They are found in the understory of open woodlands, a habitat characterized by a monsoon rainfall pattern (heavy rain for few months and essentially no rain for the balance of the year) and regular fires during the dry season. The details of this habitat and of the adaptation of these species of *Gossypium* to it are described more fully in Fryxell et al. (1992).

4. ***Gossypium cunninghamii*** Todaro.
Relaz. Cult. Coton. 110. 1877.

Fugosia punctata Cunningham ex Benth., Fl. Austral. 1: 220. 1863
(non *Fugosia punctata* Turczaninow, 1858).

Cienfuegosia benthamii Hochreutiner, *Annuaire Conserv. Jard. Bot. Geneve* 6: 55. 1902.

Notoxylinon punctatum (Bentham) Lewton, *J. Wash. Acad. Sci.* 5: 307. 1915.

Cienfuegosia punctata (Bentham) Domin, *Biblioth. Bot.* 89: 964. 1928.

Type: Australia. Northern Territory, Port Essington, *Cunningham* 264 (holotype: K; isotypes: BM, pf).

Erect to reclining, multi-stemmed perennial subshrubs, the stems glabrous, punctate. Leaves 4-9 cm long, 1.5-4.5 cm wide, short-petiolate to sessile, the blade elliptic, basally cuneate, entire, acute, pinninerved, eciliate, glabrous, punctate, with a foliar nectary 1-3 mm long at base of midrib beneath; petioles 5 mm long or less; stipules 4-5 mm long, subulate, caducous, pedicels usually solitary (or paired) in the leaf axils, 1.5-5 cm long, articulated 1-3 cm below the flower, with small bract at articulation, glabrate or obscurely puberulent, punctate; involucellar nectaries imperfectly developed or absent; involucellar bracts, ligulate, 12-20 mm long, 2-3 mm wide; calyx 1.5-2 cm long in flower, accrescent to 3.5 cm in fruit, ecostate, obscurely puberulent to glabrate, deeply 5-lobed, the lobes foliaceous, broadly lanceolate, 5-10 mm wide at base, the sinuses more or less acute; petals 3.5-4.5 cm long, white fading pink with dark maroon spot at base, sparsely punctate, the glands fairly evenly distributed; staminal column pallid, glabrous, the pollen cream-colored; style exserted, ca. 7 mm, punctate. Capsules 1.5-2 cm long, ca. 1.5 cm diameter, ovoid, glabrous, densely

punctate, 3-loculed; seeds 6-7 mm long, brown, obscurely puberulent (seemingly glabrous), with fleshy aril attached to hilum.

Distribution. Northernmost Australia on the Cobourg Peninsula (see map no. 1 in Fryxell et al., 1992).

Illustrations. Fryxell et al. (1992, fig. 6A).

Wendel & Albert (1992) present evidence indicating that *G. cunninghamii* shares its cytoplasmic component with *G. sturtianum*, as does *G. bickii*, q. v. Evidently this cytoplasmic congruity has little influence on the morphology and growth habit of the plants in question.

5. *Gossypium costulatum* Todaro, *Re-laz. Cult. Coton*. 109. 1877.

Fugosia latifolia Bentham, *Fl. Austral.* 1: 221. 1863.

Hibiscus latifolius (Bentham) Kuntze, *Revis. Gen. Pl.* 1: 69. 1891.

Cienfuegosia latifolia (Bentham) Hochreutiner, *Annuaire Conserv. Jard. Bot. Geneve* 6: 57. 1902.

Notoxylinon latifolium (Bentham) Lewton, *J. Wash. Acad. Sci.* 5: 307. 1915 (non *Gossypium latifolium* Murray, 1776).

Type: Western Australia, Careening Bay, *Cunningham* 262 (holotype: K; isotype: BM).

Multi-stemmed perennial subshrubs, the stems reclining-ascending to suberect, densely to sparsely stellate-puberulent, abundantly punctate (sometimes obscurely so). Leaf blades mostly 4-10 cm long, 3-8 cm wide, ovate to elliptic, basally truncate or subcordate (to cuneate

in elliptic leaves), entire, acute or acuminate, palmately 5-7-nerved, stellate-puberulent to glabrate, obscurely punctate, with inconspicuous foliar nectary 1-2 mm long near base of midrib beneath; petioles 1-2.5 cm long (ca. 1/4 length of blade), with pubescence like that of stem stipules subulate, 4-7 mm long. Flower; usually solitary in the leaf axils; pedicels usually 5-6 cm long in flower, to 10 cm long in fruit, with pubescence like stem, articulate at or near the base; involucellar nectaries absent; involucellar bracts, (7-) 13-20 mm long, 2-5 mm wide, ligulate; calyx more or less costulate, usually 2-3 cm long, punctate, puberulent, deeply 5-lobed, the lobes foliaceous, 4-9 mm wide at base, the sinuses acute or subacute; petals 3-4.5 cm long, white fading pink with dark maroon basal spot, obscurely punctate (or nearly eglandular?); androecium pallid (or basally purplish), the pollen yellow; style prominently punctate, exceeding androecium by 5-10 mm. Capsules 12-15 mm long, ca. 12 mm diameter, 3-loculed, ovoid, glabrous, obscurely punctate; seeds 6-7 mm long, dark brown, obscurely pubescent.

Distribution. Northwestern Australia, Kimberley region (see map no. 1 in Fryxell et al. (1992)).

Illustrations. Fryxell et al. (1992, fig. 6B).

6. **Gossypium nobile** Fryxell, Craven & Stewart, Syst. Bot. 17: 103. fig. 11. 1992.

Type; Australia. Western Australia, Kalumburu, S of community near small river, *Fryxell, Craven & Stewart 4855* (holotype: CANA; isotypes: A, BH, BH, BRI, DNA, K, L, MEL, NA, PERTH, RSA, WIR, pf).

Erect multi-stemmed shrubs 1-1.5 m tall; the stems minutely and finely puberulent (the hairs 0.1 mm long), punctate but the glands sometimes obscured by the pubescence. Leaf blades 4-12 cm long, 3.5-12 cm wide (from twice as long as wide to equally as long as wide), ovate to elliptic (narrowly so in occasional individuals in variable populations), basally truncate, entire, acute or acuminate, finely puberulent above and beneath (sometimes seemingly glabrous, but not actually so), palmately 3(-5)-nerved but often apparently penninerved by suppression of lateral nerves relative to midrib, the lateral nerves sometimes diverging from the midrib well above the base of the blade, with puberulence like stem, with single foliar nectary (2-)4-22 mm long on midrib 9-20 mm from base of blade; stipules subulate, 8-10 mm long, caducous. Pedicels solitary (or paired) in the leaf axils, 1-5 cm long (subequal to or exceeding the subtending petioles), articulated 1-2 cm below the flower, with a caducous bract at the articulation, ascending, tending to be aggregated apically, suberect or spreading (not pendent) in fruit, surmounted by trimerous involucellar nectaries; involucellar bracts, 9-14 mm long, 2-2.5 mm wide, inserted above the nectaries, triangular, entire, finely puberulent; calyx 15-22 mm long at anthesis, puberulent, punctate, more than half-divided, the lobes narrowly linear (1-3 mm wide), the sinuses broadly rounded; petals 4-4.5 cm long, white or pink with a dark maroon basal spot, unevenly punctate (the glands concentrated on the margin exposed in bud, the glands sparser to absent on the enclosed and distal margins), externally minutely pubescent especially where exposed in bud, ciliate on margins of claw; staminal

column ca. 13 mm long, glabrous, epuncate, purplish, antheriferous along length, filament sometimes purplish 1-2 mm long, the anthers purplish, the pollen yellow-orange; style exceeding the androecium by 7-10 mm, with a few glands apically. Capsules 10-17 mm long, 12-15 mm diameter, subglobose to ovoid, 3-loculed, glabrous, punctate; seeds 6-12 per capsule, 4.5-6 mm long, brown, minutely pubescent, arillate.

Distribution: Northwestern Australia, Kimberley region, from the vicinity of Kalumburu and eastward (see map no. 3 in Fryxell et al., 1992).

Illustrations: Fryxell et al. (1992, figs. 6H, 11).

7. ***Gossypium pulchellum*** (C. A. Gardner) Fryxell, Austral. J. Bot. 13: 92. 1965.

Fugosia pulchella C. A. Gardner, Forest Dept. Bull. W. Austral. 32: 63. 1923.

Cienfuegosia pulchella (C. A. Gardner) C. A. Gardner, Enum. Pl. Austral. Occid. 79. 1931.

Type: Australia. Western Australia, Vansittart Bay, *Gardner 1520* (holotype: PERTH).

Erect multi-stemmed perennial subshrubs 1 m tall, the stems (and herbage generally) densely and finely puberulent (the hairs 0.1 mm long), punctate but glands sometimes obscured by puberulence. Leaf blades mostly 3.5-8 cm long, 3-7.5 cm wide, ovate, basally shallowly cordate, entire, acuminate, palmately 5-nerved, finely and densely puberulent above and beneath, with single foliar nectary 1-2.5 mm long on midrib 4-9 mm distant from petiole, the nectary some-

what obscurely differentiated; petioles 2.5-3 cm long (1/3-1/2 length of blade), with puberulence like stem; stipules 4-6 mm long, subulate, puberulent, caducous. Pedicels solitary in the leaf axils, 1.5-4.5 cm long (subequal to or exceeding subtending petioles), articulated 9-15 mm below the flower, with a caducous bract at articulation, ascending, tending to be aggregated apically, surmounted by trimorous involucellar nectaries; involucellar bracts 7-10 mm long, 1.5-2 mm wide, triangular, entire (or apically 3-dentate or -lacinate), finely puberulent; calyx 12-15 mm long, puberulent, densely punctate (the glands tending to be aligned in rows), more than half-divided, the lobes narrowly triangular, the sinuses subacute; petals 3.5-4 cm long, pink with dark maroon basal spot, prominently punctate (the glands evenly distributed), externally minutely pubescent especially where exposed in bud, prominently ciliate on margins of claw; staminal column ca. 1.5 cm long, glabrous, pallid, epuncate, antheriferous along length, the filaments 1-2 mm long; style exceeding androecium by 6-12 mm, with a few glands toward apex. Capsules 8-11 mm long, ca. 9 mm diameter, 3-loculed, subglobose to ovoid, glabrous, densely punctate; seeds 3 per capsule, 6-7 mm long, black, glabrous to minutely pubescent, arillate.

Distribution: Northwesten Australia, Kimberley region, in the lowlands at the southern end of Vansittart Bay (see map no. 4 in Fryxell et al., 1992).

Illustrations: Fryxell (1965, Pl. 2;)

8. ***Gossypium enthyle*** Fryxell, Craven & Stewart, Syst. Bot. 17: 98. fig. 7. 1992.

Type: Australia. Western Australia, E of York Sound, approximately

30 km SW of Mitchell Plateau Mining Camp, *Fryxell, Craven & Stewart* 4676 (holotype: CANB; isotypes: BRI, DNA, K, L, MEL, NA, P, PERTH, WIR, pf)

Erect multi-stemmed perennial subshrubs ca. 1 m tall, the stems glabrate, prominently punctate. Leaf blades up to 8 cm long, almost as broad, ovate, cordate, entire, acute or acuminate, glabrous and eciliate, plamately 7-nerved punctate, with an elongate foliar nectary 6-15 mm long on midrib beneath; petioles ca. half length of blade, glabrous, punctate; stipules up to 13 mm long, narrowly subulate, caducous. Flowers solitary in the leaf axils or aggregated terminally in a corymbiform inflorescence with reduced leaves; pedicels 1-3 cm long, articulated 5-18 mm below the flower, minutely bracteate at articulation, glabrous and punctate, erect in flower, sometimes reflexed in fruits, surmounted by 3 involuellar nectaries; involuellar bracts 4-10 mm long, 1-2 mm wide, inserted above the nectaries, linear-lanceolate, with minute reddish (glandular?) hairs above to glabrate, spreading or reflexed; calyx 6-12 mm long, glabrous and eciliate, prominently and densely punctate, shallowly lobed, the lobes narrowly acuminate, the sinuses broadly rounded; petals 3.5-4 cm long, white fading pink with dark maroon basal spot, punctate more or less throughout, externally stellate-pubescent (and rose-pigmented) where exposed in bud ciliate on margins of claw otherwise, glabrous; staminal column ca. 1 cm long, pallid, epunctate, the filaments and anthers pallid; pollen yellowish; style pallid; punctate, exceeding androecium by 6-8 mm. Capsules 1-1.5 cm long, 8-10 mm diameter, 3-loculed, glabrous,

prominently punctate, minutely apiculate; seeds generally 3 per capsule, 6-7 mm long, blackish, short-pubescent, arillate.

Distribution: Northwestern Australia, Kimberley region (see map no. 1 in Fryxell et al., 1992).

Illustrations: Fryxell et al. (1992, figs. 6J, 7)

9. *Gossypium marchantii* Fryxell, Craven & Stewart, Syst. Bot. 17: 103. fig. 10. 1992.

Type: Australia. Western Australia, SW of Parry Harbour on Bougainville Peninsula [14°2'S, 126°4'E], monsoon forest, common, 14 June 1985; *Fryxell, Craven & Stewart* 4797 (holotype: CANB; isotypes: PERTH pf).

Suberect to decumbent perennial subshrubs, the stems minutely and sparsely stellate-puberulent, prominently punctate. Leaf blades mostly 5-8 cm long, as wide as long or somewhat narrower, ovate, basally cordate to nearly truncate, entire, acute or gradually acuminate, minutely and evenly stellate-pubescent above, more sparsely so beneath, the hairs denser on the veins; foliar nectary inconspicuous, 1-2 mm long, midrib 5-10 mm (or more) distant from petiole; petioles 3-4 cm long ca. half length of blade, minutely stellate-puberulent; stipules 5-8 mm long, less than 1 mm wide, narrowly lanceolate, minutely pubescent. Pedicels axillary, subequal to subtending petiole or slightly longer, articulated 5-15 mm below the flower, with small bract at articulation, erect forming an acute angle with stem, minutely pubescent, more densely so above the articulation, sharply recurved in fruit, surmounted by

trimerous involuellar nectaries; involuellar bracts 6-8 mm long, 2-3 mm wide at anthesis (accrescent in fruit, to 13 mm long, 4 mm wide) triangular, punctate, ultimately reflexed; calyx 12-16 mm long (apparently not accrescent), minutely and evenly stellate-pubescent (hairs 0.1-0.2 mm long), evenly punctate, ca. half-divided, the lobes narrowly acuminate, the sinuses acute to rounded; petals ca. 4 cm long, white or pink with dark maroon basal spot, with a few glands (ca. 10-15) in the distal auriculate "lobe" of blade, otherwise eglandular; staminal column ca. 8 mm long, pallid, eglandular, the filaments 2 mm long, the anthers reddish, the pollen yellow-orange; style exceeding androecium by 5 mm, punctate. Capsules [immature] ovoid or subglobose, glabrous, densely punctate, 3-loculed.

Distribution: Northwestern Australia, Kimberley region (see map no. 3 in Fryxell et al. (1992).

Illustrations: Fryxell et al. (1992, fig. 6G 10).

10. ***Gossypium populifolium*** (Benth.) F. Mueller ex Todaro, Relaz. Cult. Coton. 107. 1877.

Fugosia populifolia Benth., Fl. Austral. 1: 221. 1863.

Hibiscus populifolius (Benth.) Kuntze, Revis. Gen. Pl. 1: 69 1891 (non *Hibiscus populifolius* Salisbury, 1796).

Cienfuegosia populifolia (Benth.) Hochreutiner, Annuaire Conserv. Jard. Bot. Geneve 6: 57. 1902.

Notoxylinon populifolium (Benth.) Lewton, J. Wash. Acad. Sci. 5: 306 1915.

Type: Western Australia, Bynoe s. n. (lectotype: K)

Reclining, ascending, or suberect perennial subshrubs, the stems glabrous, punctate (sometimes obscurely so), sometimes suffused with reddish pigment. Leaf blades mostly 2-5 cm long, 4-5 cm wide, broadly ovate, deeply cordate basally, entire, usually short-acuminate (rarely obtuse), obscurely ciliate on margin, otherwise glabrous, with foliar nectary 1-2 mm long on midrib beneath 1-5 mm distant from petiole; petiole up to 5 cm long, subequal to blade or exceeding blade, obscurely pubescent distally; otherwise glabrous; stipules 3.5-3 mm long, subulate, glabrous. Pedicels 1.5-4.5 cm long (subequal to or exceeding subtending petiole), articulated 1-3 cm below the flower, with a caducous bract at articulation, solitary, axillary, ascending (i. e. forming an acute angle with the stem), sharply recurved following anthesis, essentially glabrous, surmounted by trimerous involuellar nectaries; involuellar bracts 3, 3-7 mm long, 1 mm wide, inserted above nectaries, subulate, or triangular, glabrous; calyx 9-18 mm long at anthesis, glabrous or minutely and obscurely pubescent, ecostate, punctate (glands not prominent and relatively few), ca. half-divided or less, the lobes acuminate to caudate, the sinuses subacute to broadly rounded; petals 3-3.5 cm long, epunctate to with glands confined to external margin, white or pink with dark maroon basal spot internally; staminal column ca. 1 cm long, epunctate, the filaments ca. 1 mm long; style slightly exceeding the androecium. Capsules 18 mm long, 14 mm diameter, ovoid, glabrous, prominently punctate, 3-loculed; seeds 6-7 mm long, blackish, densely and minutely pubescent (the hairs whitish),

with a yellowish fleshy aril almost as long as the seed attached to the hilum.

Distribution: Northwestern Australia, Kimberley region (see map no. 4 and discussion in Fryxell et al., 1992).

Illustrations: Fryxell et al. (1992, figs. 6F, 12).

As discussed in Fryxell et al. (1992), the name *G. populifolium* has been applied uncritically in the past to any prostrate *Gossypium* from the Kimberley region of Australia. In fact, *G. populifolium* is not prostrate, and the prostrate forms can be assigned either to *G. rotundifolium* or *G. exiguum*.

11. *Gossypium londonderriense* Fryxell, Craven & Stewart, Syst. Bot. 17: 100. fig. 9. 1992.

Type: Australia. Western Australia, 6 km S of Cape Londonderry on the S shore of the Timor Sea [13°47'S, 126°58'E], Fryxell, Craven & Stewart 4814 (holotype: CANB; isotypes: BRI, DNA, G, L, K, MEL. NA, P, PERTH, WIR, pf).

Suberect to decumbent multi-stemmed perennial subshrubs the stems punctate but glands obscured by pubescence, densely, minutely and evenly pubescent, the hairs 0.1-0.2 mm long. Leaf blades up to 8 cm long, 12 cm wide, broadly ovate (broader than long), deeply cordate, entire, obtuse to short-acuminate, palmately 7-nerved, sparsely and minutely pubescent (especially on veins) and marginally ciliate, the reticulate venation slightly raised (above and beneath), obscurely punctate with foliar nectary 2-6 (-18) mm long on midrib beneath; petioles up to 5 cm long with pubescence like

that of stem; stipules ca. 7 mm long, subulate, caducous. Flowers solitary in the leaf axils or in axillary or terminal groupings (sympodia?) of 2-5 flowers; pedicels 1-3 cm long (to 8 cm in fruit), densely and minutely pubescent, obscurely punctate, articulate and bracteate at or near base (1-6 cm below the flower); involucellar nectaries absent; involucellar bracts lanceolate, 7-12 mm long, 2-3.5 mm wide, minutely and evenly pubescent; calyx 12-18 mm long, minutely and evenly stellate-pubescent, and punctate, 5-lobed, the lobes linear-lanceolate, 1-2 mm wide, with a raised midrib, the sinuses rounded; petals 4-4.5 cm long, white fading pink with dark maroon basal spot, externally stellate-pubescent and rose-pigmented where exposed in bud, ciliate on margins of claw, otherwise glabrous, minutely punctate more or less throughout; staminal column ca. 1 cm long, glabrous, eglandular, pallid or basally purplish, the filaments pallid, the anthers reddish or lavender, the pollen yellow; style exceeding androecium by ca. 7 mm, densely punctate. Capsules 1-1.5 cm long ca. 1 cm diameter, 3-loculed, ovoid, glabrous, punctate, beaked; seeds unknown.

Distribution: Northernmost Australia, Kimberly region, at Cape Londonderry (see map no. 2 in Fryxell et al., 1992).

Illustrations: Fryxell et al. (1992, fig. 6D, 9).

15. *Gossypium rotundifolium* Fryxell, Craven & Stewart, Syst. Bot. 17: 111, fig. 14. 1992.

Type: Australia. Western Australia, road to Beagle Bay N of Broome,

10-15 km N of Junction with Broom-Derby Hwy., *Fryxell, Craven & Stewart* 4556 (holotype: CANB; isotype K, NA, PEBTH, pf).

Prostrate perennial herbs, the stems slender, minutely pilose (rarely glabrate), the hairs simple, erect, 0.1-0.3(-1) mm long (rarely glabrate), coarsely to moderately punctate. Leaf blades mostly 1.5-3 cm long, 2.5-5 cm wide, reniform or subrotund, usually broader than long, deeply cordate basally, the sinus closed, entire, obtuse or emarginate, often minutely acuminate, almost apiculate, palmately 7-nerved, the lateral nerves arcuate, minutely ciliate marginally, glabrous above and beneath, the foliar nectary 1-2 mm long at very base of midrib or sometimes partially displaced on to petiole; petioles 2/3-1 times length of blade with pubescence like that of stem; stipules 4-6 mm long, narrowly lanceolate, ciliate to glabrate. Pedicels 3-9 cm long, articulated 1-3 cm below the flower, commonly with a reduced but petiolate leaf at articulation, solitary in the leaf axils at approximately right angles to the stem or sometimes aggregated apically at more nearly acute angles, recurved in fruit with pubescence like stem; involucellar nectaries absent; involucellar bracts 7-10 mm long, 1-3 mm wide, lanceolate, punctate, obscurely ciliate to glabrate, ultimately reflexed; calyx at anthesis (1-) 1.5-2 cm long, slightly accrescent in fruit, prominently punctate, obscurely ciliate on margin, otherwise glabrate, more than half-divided, the lobes narrowly to broadly lanceolate, foliaceous, the midrib relatively prominent, light-colored, raised, the sinuses acute to rounded; petals 4-5 cm long, white or pink (fading rich

pink) with a dark maroon spot at base, epunctate; staminal column 8-15 mm long, epunctate, pallid, the filaments 1-2 mm long, the anthers and pollen pale yellowish; style exceeding androecium by 3-5 mm, with few or no black glands. Capsules 12-18 mm long, 10-15 mm diameter, 3-loculed, glabrous internally and externally, prominently punctate, ovoid-apiculate; seeds 6-15 per capsule, 4.5-6 mm long, brown to dark brown, striate-pubescent, arillate.

Distribution: Northwesten Australia, Kimberley region, (see map no. 5 in Fryxell et al., 1992).

Illustrations: Fryxell (1992, figs. 6E, 14).

13. *Gossypium exiguum* Fryxell, Craven & Stewart, Syst. Bot. 17: 98. fig. 2. 1992.

Type: Australia. Western Australia, Kimberly Region, E of the Mitchell River near the river mouth [14°40'S, 125°41'E], sandstone outcrop with overlying sandy soil, common in *Eucalyptus* woodland, 10 June 1985. *Fryxell, Craven & Stewart* 4727 (holotype: CANB; isotypes: K, NA, PERTH, pf.)

Prostrate perennial herbs, the stems glabrous to hirsute, the hairs if present simple, ca. 1 mm long. Leaf blades mostly 3.5 cm long, 3-6.5 cm wide, usually wider than long (occasionally there verse), broadly ovate or occasionally reniform, deeply cordate, entire, acute, short-acuminate or occasionally obtuse, glabrous above and beneath, usually with prominent marginal cilia, palmately 7-nerved, with a single nectary 1-2 (-4) mm long on midrib beneath, generally

2-4 mm distant from petiole; petioles 2-6 cm long, with pubescence like stem and often also with minute stellate hairs distally; stipules 6-11 mm long, 1-2 mm wide, lanceolate to falcate, glabrous or ciliate. Pedicels at anthesis 2-5 cm long, articulated 1-2 cm below flower with pubescence like stem at more or less right angles to stem, accrescent and recurved in fruit; involucellar nectaries absent or very small; involucellar bracts 8-12 mm long, 1.5-4 mm wide, narrowly triangular, ultimately reflexed, glabrous or sparsely ciliate; calyx 1-1.5 cm long, densely and evenly punctate, glabrous or sparsely pilose (hairs simple, 1 mm long), ca. half-divided, the lobes narrowly acuminate, the sinuses broadly rounded; petals 2.5-5 cm long, white with maroon basal spot, with gossypol glands confined to exposed margin; staminal column ca. 8 mm long, pallid, epunctate, the filaments ca. 2 mm long; style prominently punctate, exceeding column by 4-5 mm. Capsules 10-14 mm long, subglobose-apiculate, densely punctate, 3-loculed, glabrous; seeds 3-6 per capsule, 4-6.5 mm long, dark brown to black, obscurely pubescent, arillate.

Distribution: Northwestern Australia, Kimberley region (see map no. 2 in Fryxell et al. (1992).

Illustrations: Fryxell et al. (1992, fig. 6K 8).

14. **Gossypium pilosum** Fryxell, Austral. J. Bot. 22: 183. 1974.

Type: Australia. Western Australia, N edge of Mitchell Plateau. *Byrnes* 2316 (holotype: DNA; isotypes: DNA, pf)

Suberect to decumbent perennial subshrubs, the stems sparsely to densely

pilose, obscurely punctate, with low ridges decurrent from the stipules along the stem axis. Leaf blades mostly 4-7 cm long, 3-8 cm wide, ovate, basally cordate, entire, manifestly acute or sometimes acuminate, palmately 7-9-nerved, notably ciliate on margins, otherwise sparsely pilose especially on main beneath to glabrate, with foliar nectary 1-4 mm long, located 4-2 mm distant from petiole; petioles up to 5.5 cm long (less than 2/3 length of blade), with pubescence like that of stem; stipules 4-10 mm long, subulate to falcate. Pedicels usually solitary or paired in the leaf axils, 1.5-8 cm or longer, punctate, glabrous or sparsely pilose; involucellar nectaries poorly developed or absent; involucellar bracts 8-18(-25) mm long, 2-4 mm wide, pilose-ciliate; calyx 18-34 mm long, usually pilose, rarely glabrous, punctate, 5-lobed, the lobes acuminate-caudate to linear-lanceolate, the sinuses rounded; petals 3-3.5 cm long, nearly epunctate or with glands confined to exposed margin, white fading pink with a dark maroon basal spot; androecium pallid, the style punctate. Capsules 12-16 mm long, 10-14 mm diameter, ovoid, 3-loculed, glabrous, punctate; seeds 5-7 mm long, brown, minutely and obscurely pubescent (appearing glabrous), arillate.

Distribution: Northwestern Australia, Kimberley region, on the Mitchell Plateau north to Port Warrender (see map no. 3 in Fryxell et al., 1992).

Illustrations: Fryxell et al. (1992, figs. 6C); Dariev & Abdullaev (1985, fig. 31).

Subgenus *Sturtia*

Section *Hibiscoidea* Tadaro, Relaz. Cult. Coton. 107. 1877.

Type: *Gossypium australe* F. Mueller

Erect shrubs or subshrubs with puberulent or pubescent foliage; stems punctate, not tuberculate, the punctae often concealed by pubescence; leaves lobed or unlobed, the margins entire; involucellar bracts filiform or subulate, persistent; corolla mauve with dark center; seeds exarillate; densely pubescent, the hairs appressed or spreading.

The species of section *Hibiscoidea* are from the arid regions of central Australia. *Gossypium australe* has achieved a wider distribution than the other species, but it remains a plant of desert habitats.

15. *Gossypium australe* F. Mueller, *Fragm.* 1: 46. 1858.

Fegosia australis (F. Mueller) Eenth, *Fl. Austral.* 1: 220, 1863.

Cienfuegosia australis (F. Mueller) Schumann in Engler & Prantl, *Naturl. Pflanzenfam.* 3(6): 51. 1890.

Hibiscus australis (F. Mueller) Kuntze. *Revis. Gen. Pl.* 1: 61. 1891.

Notoxylinon australe (F. Muller) Lewton, *J. Wash. Acad. Sci.* 5: 307. 1915.

Type: Australia. Victoria River and towards the Fitzmaurice River, Oct 1855, *F. Mueller s. n.* (lectotype: K).

Shrubs 1-2 m tall, the stems softly stellate-tomentose, the hairs mostly concealing the underlying black glands. Leaves petiolate, narrowly to broadly ovate-elliptic, entire, acute or mucronate, densely stellate-tomentose above and beneath, with a prominent, elongated often reddish foliar nectary, 3-10 mm long

beneath; stipules subulate, 5-9 mm long, caducous. Flowers and fruits borne on a sympodial inflorescence, the flowers sometimes cleistogamic, the pedicels 5-15 mm long, stellate-tomentose, surmounted by 3 prominent reddish involucellar nectaries 1-3 mm long; bracts of the involucre inserted above the nectaries, linear, 8-15 mm long, equaling or shorter than the calyx; calyx campanulate, basally constricted, 9-15 mm long, deeply 5-lobed, the lobes acuminate, the sinuses rounded; punctate, the glands few, often distally placed, sometimes lacking; petals 35-40 mm long, minutely punctate, pink or mauve with dark red spot at base, ciliate on claw, pubescent externally where exposed in bud, otherwise, glabrous; staminal column pallid, glabrous, 10-nerved almost without glands, the filaments 2 mm long, pallid, the anthers pinkish; style exceeding androecium, densely punctate. Capsules 3-4-loculed, 15-20 mm long, punctate but the glands concealed by short stellate tomentum, ovoid to obovoid, more or less apiculate, the suture pubescent, the hairs 2-4 mm long; seeds 4-5 mm long, densely pubescent, the fibres brownish, straight and spreading.

Distribution: Central and northern Australia (see map in Anonymous 1968, fig. 2, and in Stewart et al., 1987, fig. 1).

Illustrations: Velicek (1969, figs. 27, 28); Saunders (1961, pl. 5); Dariev & Abdullaev (1985, fig. 33).

16. *Gossypium nelsonii* Fryxell, *Austral. J. Bot.* 22: 184. 1974.

Type: Australia. Northern Territory, Painter Spring, 25 mi NW of Alice

Springs, *Nelson 2255* (holotype: DNA; isotypes: CANB, DNA, NY, pf).

Erect subshrubs to 2 m tall, the stems densely stellate-pubescent, the hairs ca. 0.5 mm long. Leaves petiolate, elliptic to ovate (rarely weakly lobed), truncate or slightly cordate, entire, acute to obtuse but often apiculate, up to 9 cm long, half as wide to as wide as long, with a single reddish foliar nectary on the midrib beneath; stipules up to 17 mm long, linear, caducous. Flowers solitary or in sympodial inflorescences; pedicels 2-5 mm long, tomentose, surmounted by 3 reddish involucellar nectaries; involucellar bracts inserted above the nectaries, 2-8 mm long, filiform, subequal to calyx or shorter; calyx campanulate, 6-12 mm long, ca. half-divided, manifestly punctate, the glands sparse and evenly distributed; flowers commonly cleistogamous, the petals closed, 4-5 mm long, whitish (rarely chasmogamous, the petals 2.5-3 cm long, lavender with a purplish base); staminal column glabrous, the filaments 1-2 mm long, purplish. Capsules 3-5-loculed, 10-15 mm long, apically depressed and short-apiculate, the beak less than 2 mm long, nearly glabrous externally, with hairs 2-4 mm, long on suture within after dehiscence, prominently punctate, the glands black, 0.3 mm diameter, so dense as frequently to be coalesced; seeds 5 mm long, densely invested with straight fibers ca. 5 mm long.

Distribution: Central Australia, in the southern part of the Northern Territory and in west-central Queensland (see map in Stewart et al., 1987, fig. 1).

The basis for continuing to recognize

G. nelsonii as a distinct species is presented by Dariev & Abdullaev (1985, p. 218) and by Stewart et al. (1987), the latter study based on extensive field observations of this species in central Australia.

17. *Gossypium bickii* Prokhanov, Bot. Zhurn. 32: 65. 1947, nom. nov.

Fugosia pedata Bailey, Queensl. Agric. J. 25: 286. 1910.

Notoxylinon pedatum (Bailey) Lewton, J. Wash. Acad. Sci. 5: 307. 1915.

Cienfuegosia pedata (Bailey) Domin, Biblioth. Bot. 89: 964. 1928 (non *Gossypium pedatum* Watt, 1927).

Type: Australia. Queensland, Georgina River, *Bick 82* (lectotype: BRI; isolectotype: K).

Spreading shrubs ca. 0.5 m tall, the stems punctate, stellate-pubescent. Leaves petiolate, ovate-elliptic, sometimes deeply 3(-5)-lobed, truncate, entire, acute or mucronate, with scattered stellate pubescence above and beneath, with inconspicuous foliar nectary 0.5-2 mm long on midrib beneath; stipules 8-12 mm long, subulate, caducous. Flowers and fruits borne on sympodial inflorescences, the flowers sometimes cleistogamic, the pedicels 10-30 mm long, stellate-pubescent, sparsely punctate, surmounted by 3 prominent reddish involucellar nectaries 1-3 mm long; bracts of the involucre inserted above the nectaries, linear, 7-13 mm long, usually shorter than calyx; calyx broadly campanulate, basally rounded, 18-24 mm long, deeply 5-lobed, the lobes acuminate-caudate, the sinuses acute to rounded, prominently punctate, the glands evenly distributed; petals 3-4

cm long, pink or mauve (sometimes white) with dark red spot at base, minutely punctate, ciliate on claw, pubescent externally where exposed in bud, otherwise glabrous; staminal column pallid, glabrous, epunctate, the filaments 1-2 mm long, pallid, the anthers pallid; style exceeding the androecium, punctate. Capsules 3-5-loculed, 15-20 mm long (or smaller if resulting from cleistogamic flowers), glabrous and prominently punctate externally, the glands raised and sometimes coalesced, pubescent on inner suture margin, the hairs 1-2 mm long, subglobose (if small) to ovoid and long-beaked; seeds ca. 5 mm long, densely pubescent with tightly appressed fibers.

Distribution: Central Australia (see map in Anonymous 1968, fig. 2).

Illustrations: Valicek (1979, figs. 29, 30); Dariev & Abdullaev (1985, fig. 34).

Wendel et al. (1991) have presented evidence that *G. bickii* arose by homoploid reticulate speciation, which gave rise to the combination of a cytoplasmic background from a *G. sturtianum*-like ancestor with a nuclear complement from a *G. australe*-like ancestor. The same cytoplasm is found in *G. cunninghamii* (Wendel & Albert 1992), and one can conclude that it has little influence on the morphology or growth habit of the of the plants containing it.

Subgenus Houzingenia (Fryxell) Fryxell, Taxon 18: 587. 1969.

Type: *Gossypium trilobum* (DC.) Skovsted.

Section Houzingenia

Subsection Houzingenia

Erect shrubs or small trees with gla-

brous or glabrate foliage; stems pentangular, glabrate, minutely and obscurely punctate; leaves deeply lobed, the margins entire, with quadrangular petioles; involucellar bracts ovate-entire to ligulate, persistent; corolla pale yellow with or without dark center; seeds exarillate, subglabrous.

The species of subsection *Houzingenia* occur in western North America, *G. trilobum* in tropical Mexico in relatively mesic habitats, and *G. thurberi* in temperate areas to the north (Sonora and Arizona) in desert areas, often along seasonally dry stream beds. *Gossypium thurberi* is the northernmost representative of the genus, neglecting cultivated cottons, and the only one to grow in a fully temperate climate. Both species grow at relatively high elevation compared to other species of the genus.

18. *Gossypium trilobum* (DC.) Skovsted, J. Genet. 31: 288. 1935 (pro parte) emend. Kearney, Amer. J. Bot. 24: 299. 1937.

Ingenhouzia triloba DC. Prodr. 1: 474. 1824.

Hibiscus ingenhousii Kuntze, nom. nov., Revis. Gen. Pl. 1: 69. 1891.

Thurberia triloba (DC.) Tidestrom ex Dayton, Proc. Biol. Soc. Washington 40: 120. 1927.

Type: Icones Florae Mexicanae s. n. (Torner Collection acc. no. 6331. 1747, Hunt Institute).

Gossypium lanceiforme Meirs ex Britten, J. Bot. 31: 331. 1893.

Type: Mexico, Sesse & Mocino

3299, 3300 (BM, MA). [See discussion of type material in Fuertes & Fryxell (in prep.)].

Shrubs or small trees 3-4 m tall, the stems pentangular or 5-ridged when young, minutely stellate-pubescent becoming glabrate. Leaf blades mostly 7-15 cm long, cordate, 5-lobed below to 3-lobed in the inflorescence, with a single foliar nectary, ca. 4/5-divided, the lobes ovate, acuminate, up to 3.5 cm wide, ciliate-margined, otherwise glabrate; petioles 1/3-2/3 the length of the blades, quadrangular; stipules 7-10 mm long, falcate. Flowers borne on sympodial branches; pedicels 1-1.5 cm long, erect, ridged, glabrate, surmounted by 3 nectaries; bracts of the involucre 15-20 mm long, 10-12 mm wide inserted above the nectaries, distinct, cordate-ovate, entire, acuminate, persistent; calyx 5-6 mm long, prominently punctate, with an irregular number (5-10) of aristate teeth, each 1-4 mm long, corolla rotate, pale yellow with a small red basal spot, the petals 2-3.5 cm long; androecium included; pallid, the column 10 mm long, gland-dotted, the filaments 2-3 mm long; style slender exceeding the androecium. Capsules 15-18 mm long, 10-12 mm diameter, oblong, glabrous, (2-) 3-loculed, beaked, persistent, densely hairy on inner suture, the hairs 2 mm long; seeds 3-4 mm long, 8-10 per locule, angularly turbinate, blackish with minute tan pubescence (appearing glabrous).

Distribution: Mexico, in the states of Jalisco, Mexico, Michoacan, Morelos, and Sinaloa (see map in Fryxell 1988, fig. 43).

Illustrations: Fryxell (1979, fig. 20; 1988, fig. 44); Valicek (1979, figs. 35, 36); Dariev & Abdullaev (1985, fig. 38).

19. *Gossypium thurberi* Todaro, nom. nov., Relaz. Cult. Cotton. 120. 1877, based on: *Thurberia thespesioides* A. Gray, Mem. Amer. Acad. Arts n.s. 5 (Pl. Thurb.): 308. 1858 (non *Gossypium thespesioides* (R. Brown ex Bentham) F. Mueller ex Todaro, 1877).

Thespesia thurberi Alefeld, Bot. Zeitung (Berlin) 19: 301. 1861.

Type: Mexico. Sonora, between Cocospera and Babosaqui, *Thurber* 914 (holotype: GH; isotypes: NY, US).

Shrubs ca. 2 m tall, the stems pentangular when young, green, glabrate. Leaf blades mostly 5-15 cm long, subcordate, glabrous, deeply 3-5-lobed, the central lobe basally constricted, narrowly lanceolate (4-6 times as long as wide), long-acuminate, with a nectary near base of midrib beneath; petiole 1/2-3/4 the length of the blades, quadrangular; stipules 5-10 mm long, linear. Flowers borne on lateral sympodial inflorescences; pedicels 1-3 cm long, erect, glabrous, surmounted by 3 prominent nectaries; involucellar bracts 8-12 mm long, inserted above the nectaries, distinct, ligulate, entire or trifid, persistent; calyx 3 mm long, truncate, glabrous; corolla rotate, cream with a vestigial red spot at base (or spot absent), the petals 1.5-2.5 cm long; staminal column 9 mm long, glabrous, pallid, the filaments 3-4 mm long; style slightly exceeding androecium. Capsules 10-15 mm long, subglobose to oblong, 3-loculed, persistent, externally glabrous, internally pubescent on suture of dehiscence, the hairs ca. 2 mm long; seeds 3-4 mm long, blackish, subglabrous.

Distribution: Southern Arizona, Sonora, and western Chihuahua (see map in Anonymous 1968, fig. 3).

Illustrations: Fryxell (1979, fig. 21); Valicek (1979, figs. 37, 38); Saunders (1961, pl. 6); Dariev & Abdullaev (1985, fig. 39).

Subgenus *Houzingenia*

Section *Houzingenia*

Subsection *Integrifolia* (Todaro)
Todaro, Relaz. Cult. Coton. 188.
1877.

Type: *Gossypium klotzschianum*
Andersson.

Erect shrubs or subshrubs with soft-pubescent foliage; stems obscurely punctate; leaves usually unlobed, the margins entire; involucellar bracts ovate, laciniate, persistent; corolla yellow with dark center (or the dark center imperfectly developed to absent); seeds exarillate, sparsely pubescent, seemingly glabrous.

Members of subsection *Integrifolia* grow in arid habitats, frequently along seasonally dry stream beds. The two species are separated by a notable disjunction: *G. davidsonii* occurs in the southern part of the Baja California peninsula, and *G. klotzschianum* is confined to the Galapagos Archipelago. How this disjunction may have been achieved is not known, but Wendel & Percival (1990) present allozyme and cp DNA data suggesting that *G. klotzschianum* was likely derived from *G. davidsonii* by long-distance dispersal, "most likely mediated by trans-oceanic drift," and this event took place sometime between 1/4 and 3/4 of a million years ago.

20. *Gossypium davidsonii* Kellogg,

Proc. Calif. Acad. Sci. 5: 82. 1875.

Gossypium klotzschianum var. *davidsonii* (Kellogg) J.B. Hutchinson, Evol. Gossyp. 22. 1947.

Gossypium klotzschianum subsp. *davidsonii* (Kellogg) Roberty, Candollea 13: 29. 1950.

Type: Mexico. Baja California, San Jose del Cabo, Mar. 1873, *Davidson* s. n. (holotype: RSA?; isotype: GH).

Sparingly branched shrubs 1-2 m tall, the stems minutely soft-puberulent. Leaf blades mostly 3-8 cm long, ovate, cordate, simple or sometimes shallowly 3-lobed, acute or acuminate, softly tomentose above and beneath, with a small foliar nectary near base of midrib beneath; petioles usually half length of blades or less, occasionally longer; stipules 5-9 mm long, lanceolate to falcate. Flowers usually borne on lateral sympodial inflorescences; pedicels 1-2 cm long, surmounted by 3 involucellar nectaries; involucellar bracts 1.5-2.5 cm long, about as wide, cordate-ovate, 7-11-laciniate, or dentate, persistent; calyx 4 mm long, truncate or undulate, sparsely pubescent; corolla rotate, yellow with a dark center (sometimes absent), the petals 2.5-3 cm long, ciliate on margin of claw, abaxially minutely pubescent, adaxially glabrous; staminal column 7-11 mm long, pallid, glabrous or sparsely pubescent, the filaments 1-2 mm long; style exceeding the androecium. Capsules ca. 1.5 cm long, ovoid-apiculate, 4(-5)-loculed, externally glabrous, internally ciliate along suture of dehiscence, the hairs 1-2 mm long, persistent; seeds 5-6 mm long, with sparse appressed hairs (appearing glabrous).

Distribution: Mexico, Baja California Sur, from the Cape region to at least 26° north latitude; also known from the vicinity of Guaymas, Sonora (see maps in Anonymous 1968, fig. 3 and in Fryxell, 1988, fig. 42).

Illustrations: Watt (1907, fig. 3); Valicek (1979, figs. 57, 58); Saunders (1961, pl. 9); Dariev & Abdullaev (1985, fig. 49).

21. **Gossypium klotzschianum** Andersson, Kongl. Svenska Vetenskapssakad. Handl. 1853:228. 1855.

Type: Galapagos Archipelago, in insulis Chatham & Charles, 1852, *Andersson s. n.* (holotype: S) See discussion of typification in Fryxell, 1976, pp. 43-44).

Shrubs up to 4 m tall, the stems minutely stellate-tomentose to glabrate, obscurely punctate, ovate, more or less cordate, entire, acuminate, stellate-pubescent above and beneath with a small foliar nectary on the midrib beneath; stipules subulate, 15 mm long, 1.5 mm wide. Pedicels solitary in the leaf axils, articulated ca. 10 mm below the flower, with a reduced leaf at the articulation; bracts of the involucre cordate-ovate, pubescent, 10-15-laciniate, 2-3 cm long, about as broad; calyx 4-5 mm long, truncate to undulate, punctate, petals 3.5-5 cm long, yellow (or sometimes reddish at the base), more or less plicate, minutely punctate; staminal column 10-12 mm long, pallid, glabrous, epunctate, the filaments 1-2 mm long, style exceeding androecium, punctate. Capsules ovoid-fusiform, to 25 mm long, usually 4-loculed, ciliate on inner suture margins; seeds 5-6 mm long, with sparse inconspicuous fibers.

Distribution: Endemic to Galapagos Archipelago (see map in Anonymous 1968, fig. 3).

Illustrations: Valicek (1979, figs. 55, 56). Dariev & Abdullaev (1985, fig. 48);

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Section Houzingenia

Subsection Caducibracteolata

Mauer, Trudy Sredne-Aziatsk. Gosud. Univ. Lenina n. s. 81: 21. 1950.

Type: *Gossypium harknessii* Brandege.

Erect shrubs with subglabrous foliage; stems obscurely punctate, subglabrous; leaves thick, leathery, unlobed or weakly lobed, the margins entire; involucre bracts ligulate to ovate, entire or dentate, caducous at or before anthesis; corolla yellow with dark center; seeds exarillate, appressed-pubescent.

The three members of subsection *Caducibracteolata* are characteristically found in extremely arid habitats around the Gulf of California (Sea of Cortes) in Mexico. They exhibit a number of xeromorphic adaptations, such as reduced leaf size, a thick cuticle, and a double palisade layer.

22. **Gossypium harknessii** Brandege, Proc. Calif. Acad. Sci. ser. ii. 2: 136. 1889.

Ingenhouzia harknessii (Brandegee) Rose ex Tyler, U. S. D. A. Bur. Pl. Industry Bull. 131: 54. 1908.

Type: Mexico, Baja California, Isla Santa Margarita, 1 Mar 1889, *Brandegee s. n.* (holotype: US; isotypes: CAS, GH, PH, US).

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Gossypium californicum Mauer, Trudy Sredne-Aziastk. Gosud. Univ. Lenina 7: 21. 1950.

Type: Mexico, Baja California, from Cerro Colorado to Rodriguez, Nelson & Goldman 7328 (holotype: US).

Spreading shrubs up to 2.5 m tall and 3-4 m wide, the stems minutely puberulent to glabrate. Leaf blades 2-6 cm long, thick - textured, somewhat wider than long, deeply cordate, more or less 3-lobed, the lobes obtuse to acute with a small foliar nectary near base of midrib beneath; petioles 1/2-1 times length of blade; stipules ca. 2 mm long, subulate. Flowers solitary in the leaf axils; pedicels 0.5-1.5 cm long, equaling or shorter than the subtending petioles, articulated near the middle, with a caducous bract at articulation, surmounted by 3 involuellar nectaries, these sometimes obscure; involucellar bracts 9-18 mm long, 4-7 mm wide, lanceolate, entire, caducous at anthesis; calyx 6-8 mm long, truncate or obscurely 5-toothed; corolla yellow with a red center, the petals 2.5-4 cm long, ciliate-margined; staminal column 7-8 mm long, glabrous, pallid, the filaments 2-3 mm long; styles somewhat shorter than the petals. Capsules ca. 1.5 cm long, ovoid or subglobose, 3(-4)-loculed, with prominent sunken glands, externally glabrous, internally pubescent along suture of dehiscence (the hairs 1-2 mm long), flaring widely at maturity; seeds 8-10 mm long, grayish with tightly appressed hairs.

Distribution: In Mexico, in Baja California Sur, from the Cape region to the vicinity of Loreto (See map in Anonymous 1968, fig. 3).

Illustrations: Saunders (1961, pl. 8);

Velicek (1979, figs. 52, 53); Dariev & Abdullaev (1985, fig. 46).

23. *Gossypium armourianum* Kearney, J. Wash. Acad. Sci. 23: 558. 1933.

Gossypium harknessii subsp. *armourianum* (Kearney) Roberty, Candollea 13: 25. 1953.

Type: cultivated at Palm Springs, California, from seeds from Isla San Marcos, Baja California, 25 Aug 1933, Kearney s. n. (holotype: US; isotypes: CAS, F, GH, NY).

Compact widely branched shrubs ca. 1 m tall, the stems (and most plant parts) obscurely puberulent to glabrate. Leaf blades 1.5-3 cm long and as wide or wider, thick-textured, ovate, more or less cordate, acute or subacuminate, with a foliar nectary near base of midrib; petioles 1/2-1 times length of blades; stipules 1-3 mm long, subulate. Flowers solitary in the leaf axils; pedicels 2-6.5 cm long, exceeding the subtending leaves, medially articulated, with a reduced leaf at articulation, surmounted by 3 prominent nectaries; involucellar bracts 1-3 mm wide, ligulate, inserted above the nectaries, caducous well before anthesis; calyx 5-7 mm long, subtruncate or 5-toothed; corolla yellow with a red center, the petals 2.5-4.5 cm long, ciliate on margins of claw, otherwise glabrous; staminal column 12-14 mm long, glabrous, pallid, the filaments 2-4 mm long; styles somewhat shorter than the petals. Capsules ca. 1.5 cm long, subglobose or ovoid-apiculate, 3-4-loculed, with sunken glands, externally glabrous, internally hirsute along suture of dehiscence (hairs 1 mm or more), dehiscent and flaring widely at maturity; seeds ca. 8 mm long, with tightly appressed brownish hairs.

Distribution: In Mexico, from the Isla San Marcos in the Gulf of California at 27°15'N, and also on the eastern coast of Baja California from Punta Trinidad (ca. 27°49'N) to San Francisco Bay (ca. 28°30'N).

Illustrations: Sanunders (1961, pl. 7); Valicek (1979, figs. 50, 51); Dariev & Abdullaev (1985, fig. 45).

24. **Gossypium turneri** Fryxell, *Madrono* 25: 155. 1978.

Type: Mexico. Sonora, western base of Tetas de Cabra (near San Carlos Bay), 27°9'N, 111°1'W, *Turner Goldberg* 77-49 (holotype: ARIZ; isotype: CHAPA, MEXU, UC, pf).

Spreading shrubs ca. 1 m tall, the younger stems stellate-tomentulose, the older stems with red-brown bark and prominent lenticels. Leaf blades thick-textured, 2-4 cm long, equally wide, cordate, shallowly 3-lobed, acute to obtuse, subglabrous, with a foliar nectary near base of midrib beneath; petioles equaling or exceeding the blades; stipules 3-7 mm long, subulate. Flowers solitary in the leaf axils; pedicels ca. 2 cm long, equaling or exceeding the subtending petioles, medially articulate, with caducous bract at articulation, surmounted by 3 prominent nectaries; involucellar bracts 9-26 mm long, 7-9 mm wide, inserted above the nectaries, ovate, usually lacinate, caducous at anthesis; calyx 5-8 mm long, subtruncate, subglabrous, prominently punctate; corolla yellow with a red center, the petals 4-4.5 cm long; staminal column 16-17 mm long, glabrous, pallid, the filaments 5-6 mm long; style somewhat shorter than the petals. Capsules

1-1.5 cm long, globose to ovoid, 3-5-loculed, prominently glandular, flaring widely at maturity, externally glabrous, internally hirsute on suture of dehiscence, the hairs 2 mm long; seeds 7-8 mm long; brownish with tightly appressed hairs.

Distribution: Mexico, Sonora, in the of Bahia San Carlos (see map in Fryxell 1988, fig. 43).

Illustrations: Fryxell (1978b, fig. 1).

Subgenus *Houzingenia*

Section **Erioxylum** (Rose & Standley) Prokhanov, *Bot. Zhurn.* 32: 71. 1947.

Type: *Erioxylum aridum* Rose & Standley [= *Gossypium aridum* (Rose & Standley) Skovsted].

Subsection **Selera** (Ulbrich) Fryxell, *Taxon* 18: 588. 1969.

Type: *Selera gossypioides* Ulbrich [= *Gossypium gossypioides* (Ulbrich) Standley].

Erect shrubs with subglabrous or somewhat pubescent foliage; stems puberulent, obscurely punctate; leaves lobed, the margins entire; involucellar bracts ovate, entire, connate prior to anthesis, persistent; corolla rose-lavender with dark center; seeds exarillate, appressed-pubescent.

Subsection *Selera* is monotypic, and its distinctive species occurs in arid shrublands in central Oaxaca in southern Mexico.

25. **Gossypium gossypioides** (Ulbrich) Standley, *Contr. U. S. Natl. Herb.* 23: 783. 1923 (non *Gossypium*

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gossypoides (Sturt) C. A. Gardner, 1931.

Selera gossypoides Ulbrich, Verh. Bot. Vereins Prov. Brandenburg 55: 51. 1913.

Type: Mexico. Oaxaca, San Bartolo Yautepec, *Seler & Seler 1700* (holotype: B, destroyed); Mexico. Oaxaca, 39 km W of Tequisistlan, *Fryxell 757* (neotype: US; isoneotypes: F, MEXU, MO, NA, TAES, UC, pf).

Large shrubs or small trees 3-6 m tall, the stems minutely puberulent. Leaf blades mostly 7-16 cm long, prominently cordate, more or less deeply 3-lobed, the lobes entire, acuminate, subglabrous except for the nerves; foliar nectaries absent; petioles 1/2-2/3 the length of the blades, rarely subequal to blades; stipules 5-10 mm long, subulate. Flowers generally borne in lateral sympodial inflorescences; pedicels 2-3 cm long, minutely puberulent; involucellar nectaries absent; involucellar bracts 2.5-4.5 cm long, almost as wide, cordate-ovate, entire, acuminate, marginally connate by interlocking hairs prior to anthesis, enclosing bud and fruit, persistent; calyx 4-5 mm long, glabrous, truncate or undulate; corolla funnelform, rose-lavender with a red-purple throat on lower half within, the petals 4.5-5.5 cm long, ciliate on margin especially at base; staminal column ca. half the length of the petals, pallid, glabrous, the filaments ca. 2 mm long, often purplish, the anthers yellowish; style slightly exceeding the androecium. Capsules ca. 1.5 cm long, broadly ovoid, 3-loculed, glabrous, prominently punctate, abscising (with the involucler) at maturity; seeds

7 mm long, with dense short grayish appressed pubescence.

Distribution: Mexico, in the central part of the state of Oaxaca (see map in Anonymous 1968, fig. 3).

Illustrations: Ulbrich ((1913, p. 169), reprinted by Fryxell (1979, fig. 24); Saunders (1961, pl. 12); Valicek (1979, figs. 39, 40); Dariev & Abdullaev (1985, fig. 40).

Subgenus *Houzingenia*Section *Erioxylum*

Subsection *Erioxylum* (Rose & Standley) Fryxell, Taxon 18: 588. 1969.

Trees with minutely pubescent (sometimes glabrous) foliage; stems minutely punctate, pubescent or glabrous; leaves unlobed or shallowly lobed, the margins entire; involucellar bracts reduced to small triangular scales, appressed, persistent; corolla pink or rose-lavender with dark center; seeds exarillate, appressed-pubescent.

Subsection *Erioxylum* includes four arborescent species from western Mexico, growing in deciduous forest in a wet-season/dry-season climatic regime. They are distinctively adapted to this regime by commencing vegetative growth with the advent of the wet season, progressively losing their foliage with the advance of the dry season, and flowering and fruiting when leafless during the height of the dry season. After fruit maturation, they remain dormant until the next cycle begins with the return of the rains. No other species of *Gossypium* have this pattern.

26. *Gossypium aridum* (Rose & Standley ex Rose) Skovsted, J. Genet. 28: 422. 1934.

Erioxylum aridum Rose & Standley
ex Rose, Contr. U. S. Natl. Herb.
13: 307. 1911.

Type: Mexico. Sinaloa. vicinity of
Culiacan, *Rose, Standley & Russell*
14999 (holotype: US; isotypes: GH,
K, NY, NO, UC, US).

Cienfuegosia palmeri Rose, Contr.
U. S. Natl. Herb. 1: 308. 1895.

Erioxylum palmeri (Rose) Rose,
Contr. U. S. Natl. Herb. 13: 308.
1911.

Gossypium rosei Prokhanov, Bot.
Zhurn. 32: 72. 1947, nom. nov.
(non *Gossypium palmeri* Watt,
1907).

Gossypium aridum var. *palmeri*
(Rose) Mauer, Orig. Syst. Cotton
265. 1954.

Type: Mexico. Colima, in shady
woods about Colima, 1891, *Palmer*
1376 (holotype: US; isotypes: GH,
MEXU, NY).

Trees 4-10 m tall (occasionally
shrubs) the stems minutely puberulent,
eventually glabrate. Leaves spirally
disposed, the blades mostly 6-15 cm
long, broadly to narrowly ovate (rarely
obscurely trilobulate), truncate or weakly
cordate, acuminate, more or less minu-
tely stellate-pubescent, palmately 5-ner-
ved; foliar nectaries obscurely developed
or absent; petioles 1/5-1/2 length of bla-
des; stipules 1-2 mm long, subulate.
Flowers solitary or paired in the leaf
axils, mostly appearing after the leaves
fall; pedicels 2-8 mm long, yellowish
puberulent, surmounted by 3 prominent
bordered nectaries; involucellar bracts
2-4 mm long, each inserted above a nect-

ary, triangular, entire; appressed persi-
scent; calyx 6-9 mm long, yellowish
farinose, shallowly 5-dentate; corolla
funnelform, rose or lavender with a dark
red or purplish throat, the petals 3.5-5
cm long; staminal column ca. half the
length of the petals, pallid, the filaments
3-4 mm long, purplish, the anthers pur-
plish, the pollen yellow-orange; style
exceeding androecium. Capsules 2-2.5
cm long, 1-1.5 cm diameter, narrowly
ovoid, glabrous, 3(-4)-loculed, fully
dehiscent but not flaring widely; seeds
4-6 mm long, numerous, with dense
brown hairs tightly appressed to the seed.

Distribution: In Mexico, from the state
of Colima, Guerrero, Jalisco, Mexico,
Michoacan, Nayarit, Oaxaca, Puebla,
Sinaloa, and Veracruz (see map in
Fryxell 1988, fig. 38).

Illustrations: Saunders (1961, pl. 10);
Fryxell (1979, fig. 22; 1988, fig. 41).
The illustration presented by Valicek
(1979, fig. 43) and reprinted by
Dariev & Abdullaev (1985, fig. 41)
is evidently of an interspecific
hybrid, probably *G. aridum* x *G.*
lobatum, two species that are known
to have hybridized in the Iguala
Winter Garden (Iguala, Guerrero,
Mexico), the presumed source of
Valicek's seed.

Gossypium aridum is distributed over
a wide area in Mexico, principally on
the west coast, in seasonally dry deci-
duous forest and thorn forest. It shows
a significant amount of variability over
this area. Some variants that appear
distinctive are not here recognized taxo-
nomically as distinct because they are
not judged to differ sufficiently for such
recognition. For example, there are
populations in the foothills inland from

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Tepic, Nayarit, that have coarsely and densely pubescent calyces. A superficial examination of a flowering specimen suggests that the plant is distinct from *G. aridum*, but a careful study of the plants (including examination of populations in the field) shows no particulars whereby these plants can be distinguished, other than the relatively pubescent calyx. Similarly, populations in the upper drainage of the Mexcala (Balsas) River near Acatlan, Puebla, include plants that have significantly more pubescent herbage than is typical of *G. aridum*, but again, no other characters can be cited to support the recognition of these populations as distinct.

On the other hand, populations in the Infiernillo Valley in Michoacan, which superficially look very like *G. aridum*, can on closer study be distinguished by a series of many characters (see key). On this basis, these plants are recognized as distinct and are treated here as *G. schwendimanii*.

Wendel & Albert (1992) present evidence from studies of cp DNA that *G. arboreum* shares a cytoplasmic component with *G. klotzschianum* and *G. davidsonii* (of sect. *Integrifolia*), rather than with the other members of subsect. *Erioxylum*. This cytoplasmic component evidently has little influence over the morphology, ecology, or life cycle of the plants.

27. ***Gossypium schwendimanii*** Fryxell & S. Koch, *Aliso* 11: 546, fig. 4. 1987.

Type: Mexico. Michoacan, Mpio. de Arteaga, carretera a El Infiernillo, 22 km al sur del entronque con la

carretera Arteaga-Nueva Italia, Koch & Fryxell 83239 (holotype: CHAPA; isotypes: MEXU, pf).

Trees to 4 m tall, the branch tips drooping, the bark grayish. Leaves spirally disposed, the blades mostly 4-8 cm long, about as wide as long, broadly ovate, deeply cordate to truncate, acuminate, essentially glabrous, palmately 5-7-nerved, with a small foliar nectary near base of midrib beneath; petioles 1-3 cm long, very sparsely pubescent to glabrate; stipules minute and early caducous. Flowers solitary (rarely paired) in the leaf axils, mostly appearing after the leaves fall; pedicels 4-7 mm long, stout (1-1.4 mm diameter), glabrous, sometimea suffused with pink, surmounted by 3 sunken involucellar nectaries; involucellar bracts 1-2 mm long, erect, inserted above the nectaries, triangular, sometimes obscurely 2-3 toothed, persistent; calyx 5-7 mm long, subtruncate and minutely 5-toothed, glabrous except ciliate on margin; corolla narrowly funnelform, yellowish suffused with lavender, dark purple on lower half within, the petals 3.5-4 cm long, abaxially stellate-pubescent where exposed in bud, otherwise glabrous, staminal column 2.5-3 cm long, glabrous, pallid, epunctate, the filaments ca. 3 mm long, the anthers purple; style exceeding the androecium, punctate. Capsules 2-2.5 cm long, narrowly ovoid, 3-loculed, dehiscent but not flaring widely, verruculate, glabrous; seeds 10-12 mm long, narrowly turbinate, densely hairy, the hairs grayish.

Distribution: Mexico, in the state of Michoacan, endemic to the valley of El Infiernillo (see map in Fryxell 1988, fig. 43).

Illustrations: Fryxell & Koch (1987 fig. 4).

28. *Gossypium lobatum* H. Gentry, Madrono 13: 261. 1956.

Type: Mexico. Michoacan, Canon del Marques between Uruapan and Apatzingan, Gentry 12314 (holotype: US; isotypes: ARIZ, LL, MICH, US).

Trees 3-7 m tall, the branches lax, minutely stellate-pubescent, becoming glabrate in age. Leaf blades mostly 7-15 cm long, usually wider than long, distichously arranged, deeply cordate (the sinus open or closed), divaricately 3-5-lobed, pedately nerved, obscurely punctate, minutely stellate-pubescent; petioles 1/4-1/2 the length of the blades; foliar nectaries small; stipules 8-10 mm long, lanceolate to falcate. Flowers in fascicles of 1-5 in the leaf axils, mostly appearing after the leaves fall; pedicels 3-8 mm long, stout, glabrate, surmounted by 3 prominent sunken nectaries; involucellar bracts inserted above the nectaries, broadly triangular, acute to obtuse, entire, appressed, nearly glabrous, persistent; calyx 12-15 mm long, yellowish, densely stellate-pubescent, manifestly 5-lobed, the lobes 6-10 mm long, 1-nerved, acuminate, the sinuses rounded; corolla funnellform, lavender, purplish on lower half within, the petals 4-5 cm long; staminal column ca. 2 cm long, glabrous, the filaments 3-5 mm long, the anthers purplish, the pollen yellow-orange; style exceeding androecium, slender. Capsules 2-3 cm long, 1.5 cm diameter, ovoid, 3-loculed, dehiscent but not flaring widely, minutely pubescent becoming glabrate, prominently punctate, the glands raised, each 0.5-1 mm in diameter; seeds 10-11 mm long, several per locule, densely

pubescent, the hairs grayish or tan, appressed.

Distribution: Mexico, in the central part of the state of Michoacan (see map in Fryxell & Koch 1978).

Illustrations: Gentry (1956, fig. 1), reprinted by Fryxell (1979, fig. 23); Valicek (1989, figs. 45, 46); Fryxell (1988, fig. 41); Dariev & Abdullaev (1985, figs. 42, 44).

Dariev & Abdullaev (1985) propose subsection *Lobata* Dariev, op. cit, 228 (1985) to include *G. lobatum* and *G. laxum*, distinct from subsection *Erioxylum*, which they restrict to the single species, *G. aridum*. This distinction is not here considered tenable or taxonomically meaningful.

29. *Gossypium laxum* Phillips, Madrono 21: 265, 1972.

Type: Mexico. Guerrero: between Milpillas and Xochipala, Phillips 945 (holotype: NCSU).

Small trees to 7 m tall, the young twigs stellate-pubescent, the older branches with brownish bark and paler lenticels. Leaves spirally disposed; the blades mostly 9-15 cm long, at least as wide, deeply cordate, manifestly 3(-5)-lobed, the lobes acuminate, stellate-pubescent beneath, subglabrous above, pedately 7-nerved, the foliar nectary weakly developed or absent; petioles 1/3-1 times the length of the blades; stipules 3-4 mm long, subulate. Flowers solitary in the leaf axils, mostly appearing after the leaves fall; pedicels 4-7 mm long, stout, glabrate, surmounted by 3 prominent nectaries; involucellar bracts 1.5-3 mm long, inserted above the nectaries, broadly

triangular, appressed, persistent; calyx 8-10 mm long, subtruncate with 5 apiculate teeth, glabrous; corolla pink, the lower half dark red within, the petals 5-8 cm long, abaxially pubescent, adaxially glabrous; staminal column ca. 2.5 cm long, pallid glabrous, the filaments 4-8 mm long, reddish; style exceeding the androecium. Capsules 3-4 cm long, ovoid, 3-loculed; glabrous, dehiscent but not flaring widely; seeds 6-8 mm long, densely pubescent, the hairs tan.

Distribution: Mexico, in the central part of the state of Guerrero, Canon del Zopilote.

Illustrations: Valicek (1979, figs. 47, 48); Dariev & Abdullaev (1985, figs. 43, 44).

Subgenus Houzingenia

Section Erioxylum

Subsection **Austroamericana** Fryxell, Taxon 18: 589. 1969.

Type: *Gossypium raimondii* Ulbrich.

Shrubs with soft-pubescent foliage; stems punctate, the punctae often concealed by the pubescence; leaves unlobed, the margins entire; involucellar bracts ovate, fimbriate, persistent; corolla lavender with dark center; seeds exarillate, appressed-pubescent.

Subsection *Austroamericana* is monotypic and disjunct from the other American diploid species. It occurs on the dry western slopes of the Andes in northern Peru, but appears to be confined to flood plains along streams draining the higher elevations. Its single species, *G. raimondii*, shows no clear xero-

morphic adaptations, and perhaps with a strong root system it experiences little or no water stress.

30. *Gossypium raimondii* Ulbrich, Notizbl. Bot. Gart. Berlin-Dahlem 11: 548. 1932.

Gossypium klotzschianum subsp. *raimondii* (Ulbrich) Roberty, Candollea 13: 29. 1950.

Type: Peru. Dept. Cajamarca, Prov. Contumaza, Playa del Rio de Santa Ana por lado de Cascas, *Raimondi 8218* (B, USM).

Large shrub 2-3 m tall, the stems softly stellate-tomentose, punctate (though glands partially concealed by tomentum), weakly pentangular. Leaves petiolate, broadly ovate, cordate, entire, acuminate, softly tomentose above and beneath, palmately 9-11-nerved, the nerves prominently and the lamina obscurely punctate, with 1-3 foliar nectaries on principal nerves beneath near base; stipules subulate to falcate, 7-10 mm long, 1-3 mm wide, caducous. Flowers and fruits borne on 1-2-flowered sympodia, the pedicels 5-20 mm long, stout and fluted, stellate-tomentose; involucellar nectaries present but often obscured by pubescence; bracts of the involucre broadly ovate, punctate, pubescent, deeply fimbriately divided, the divisions 15-20, caudate-acuminate; calyx 5 mm long, truncate, punctate, pubescent; petals 4-4.5 cm long, lavender with dark red spot at base, minutely punctate, ciliate on margin of claw and pubescent externally where exposed in bud, otherwise glabrous; staminal column glabrous, sparsely punctate, more or less purplish (especially the filaments); style exceeding

the androecium epunctate. Capsules 4-loculed, narrowly ovoid, 20-25 mm long, glabrous, densely punctate, seeds 8 mm long, densely pubescent, the fibers tan, more or less appressed.

Distribution: Peru, in Depto. Cajamarca and Depto. La Libertad. (see map in Anonymous 1968, fig. 3).

Illustrations: Saunders (1961, pl. 12), reprinted by Fryxell (1979, fig. 25); Valicek (1979, figs. 59, 60); Dariev & Abdullaev (1985, figs. 50, 51).

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Type: *Gossypium arboreum* L.

Section *Gossypium*

Subsection *Gossypium*

Shrubs or subshrubs with pubescent to glabrate foliage; stems minutely punctate; leaves lobed, sometimes deeply so, the margins entire; involucellar bracts ovate, entire or dentate, persistent; corolla usually yellow with dark center (sometimes white or rose or lacking dark center); seeds exarillate, bearing long fibers (cotton).

Members of subsection *Gossypium* are known primarily in cultivation (principally in Asia, the Middle East, and parts of Africa). One evidently wild form, *G. herbaceum* var. *africanum*, occurs in arid parts of southern Africa as a part of the indigenous vegetation. Wendel et al. (1989) have shown, using allozyme data, that *G. arboreum* and *G. herbaceum* are clearly differentiated species and have concluded that the two were independently domesticated from previously divergent ancestors, rather than having diverged after domestication.

31. *Gossypium arboreum* Linnaeus, Sp. Pl. 693. 1753.

Type: "3 arboreum" (holotype: LINN-874.3).

More than 20 synonyms are cited by Fryxell (1979, pp. 62-64).

Shrubs or subshrubs up to 2 m tall, highly variable in morphology and pubescence, the stems usually puberulent to pubescent, punctate. Leaves petiolate, pedately 7-9-nerved, moderately to deeply palmately 3-7-lobed, sometimes with small accessory lobes in the sinuses, the lobes broadly ovate to narrowly lanceolate and more or less constricted basally, entire, acute or acuminate, the foliar nectary inconspicuous or absent; stipules 5-15 mm long, narrowly or broadly falcate, caducous. Flowers and fruits borne on sympodial inflorescences, the pedicels 10-60 mm long, the involucellar nectaries commonly absent; bracts of the involucl broadly ovate, more or less connate basally forming a cup, pubescent externally, glabrous internally, entire or 3-7-laciniate, 20-35 mm long, almost as wide; a trio of nectaries sometimes present within the involucl at the juncture of involucl and calyx alternate with the bracts; calyx 7-12 mm long, glabrous, prominently punctate, truncate to distinctly 5-lobed; petals 25-45 mm long, usually yellow with a purplish basal spot, sometimes white or flushed purplish or with basal spot absent, minutely punctate, ciliate on claw, pubescent externally where exposed in bud, glabrous internally; staminal column glabrous, pallid, usually punctate half length of petals or less, the filaments 2-4 mm long; style only slightly exceeding androecium. Capsules usually 3-loculed, ovoid to elongate, usually beaked, glabrous, punctate, the glands

Interpretation of *Gossypium*

sunken, flaring widely at maturity; seeds bearing white or tan fibers.

Distribution: Not certainly known from the wild, cultivated principally in southern Asia.

Illustrations: Watt (1907, figs. 7-18); Valicek (1979, figs. 64, 65); Draiev & Abdullaev (1985, figs. 54, 55).

32. *Gossypium herbaceum* Linnaeus, Sp. Pl. 693. 1753.

Type: "1 herbaceum" (holotype: LINN-874. 1).

Several synonyms are listed by Fryxell (1979).

shrubs or subshrubs up to 1.5 m tall, the stems usually hirsute, more or less punctate. Leaves petiolate, pedately 7-9-nerved, moderately palmately 3-5-lobed, the lobes broadly ovate, usually somewhat constricted basally, entire, acuminate, the foliar nectary inconspicuous; stipules subulate, 8-13 mm long, caducous. Flowers and fruits borne on sympodial inflorescences, the pedicels 1-3 cm long, the involucellar nectaries commonly absent; bracts of the involucre broadly ovate, cordate, frequently flaring, 5-13-nerved, pubescent externally, glabrous internally except on teeth, 2-3.5 cm long, almost as broad, a trio of nectaries sometimes present within the involucre at the juncture of involucre and calyx alternate with the bracts; calyx 5-7 mm long, glabrous, prominently punctate, truncate to undulately 5-lobed; petals 3-4 cm long, yellow with a purplish basal spot, minutely punctate to virtually epunctate, ciliate on claw, pubescent externally

where exposed in bud, glabrous internally; staminal column glabrous, pallid, densely punctate to epunctate, half length of petals or less, the filaments 2-3 mm long; style barely exceeding androecium. Capsules 3-4-loculed, more or less globose, glabrous, obscurely punctate, not opening widely at maturity; seeds bearing usually white fibers.

Distribution: A wild form (var. *africanum*) occurs in southern Africa; it is cultivated principally in the Middle East, but is now being displaced in cultivation by other species.

Illustrations: Watt (1907, figs. 19-25); Saunders (1961, pl. 19); Valicek (1979, figs. 62, 63); Dariev & Abdullaev (1985, figs. 53, 55).

Subgenus *Gossypium*

Section *Gossypium*

Subsection *Anomala* Todaro. Relaz. Cult. Cotton. 120. 1877.

Type: *Gossypium anomalum* Wawra ex Wawra & Peyritsch.

Erect shrubs or subshrubs with pubescent foliage; stems punctate, pubescent; leaves lobed, the margins entire; involucellar bracts ligulate, entire or apically dentate, persistent; corolla yellow with dark center; seeds exarillate, appressed-pubescent,

The species of subsection *Anomala* characteristically grow in arid to extremely arid parts of Africa, including the Cape Verde Islands. Holubec (1987, 1990) notes the close concordance in distribution of certain of the African species of subsect. *Anomala* with particular vegetation zones.

Vollesen (1987) interpreted the disjunct distribution of what has formerly been regarded as a single species, *G. anomalum*, as two distinct taxa, which he treated in subspecific rank. I follow this interpretation here. He also submerged *G. capitis-viridis* in *G. anomalum* subsp. *senarensis*, but I do not believe this synonymization can be supported (nor did Holubec 1990), and continue to recognize the Cape Verde plant in specific rank as *G. capitis-viridis*, which is distinguished by a constellation of characters, not all of which were considered by Vollesen (1987).

33. ***Gossypium anomalum* Wawra & Peyritsch**, Sitzungsber. K. Akad. Wiss. Math.-Nat. Cl. 38: 561. 1860 (non *Gossypium anomalum* Watt, 1927).

Hibiscus anomalus (Wawra & Peyr.) Kuntze, Rev. Gen. Pl. 1: 68. 1891.

Cienfuegosia anomala (Wawra & Peyr.) Gurke, Bot. Jahrb. Syst. 19 (Beibl. 48): 2. 1894.

Types: Angola, Wawra 262, 285 (syntypes: W).

Shrubs 1-2 m tall, the stems pubescent, punctate. Leaves petiolate, pedately 7-nerved, deeply 5-lobed, the lobes ovate, basally constricted (the sinuses closed), entire, acuminate, stellate-pubescent above and beneath, with 1-3 inconspicuous foliar nectaries on principal veins beneath; stipules subulate, 4-5 mm long. Flowers and fruits solitary in the leaf axils or borne on sympodial inflorescences, the pedicel 5-15 mm long, with pubescence like that of stem, surmounted by 3 involuellar nectaries; bracts of the involucler inserted

above the nectaries, ligulate, more or less reflexed, 11-22 mm long, 2-5 mm wide, entire or apically trifid; calyx 7-10 mm long, 5-lobed, the lobes acuminate, stellate-pubescent, punctate; petals 25-40 mm long, pale yellow with a dark red spot at base, sparsely and minutely punctate, staminal column pallid, glabrous, epunctate, ca. 10 mm long, the filaments 1 mm long; style exceeding the androecium, sparsely punctate. Capsules ovoid-beaked, 15-20 mm long, 3-loculed, glabrous, prominently punctate, the glands few, raised, up to 1 mm in diameter; seeds ca. 6 mm long, densely pubescent, the fibers brownish, appressed.

Gossypium anomalum* subsp. *anomalum

Cienfuegosia pentaphylla Schumann Bot. Jahrb. Syst. 10: 48. 1889.

Type: Namibia. Hereroland, in lapidosis prope Otyimbingue, 900 m, Marloth 1321 (holotype: B-destroyed; isotypes: K-fragment, OXF).

Distribution: Angola and Namibia (see Map 1 in Vollesen, 1987; map 2 in Holubec, 1990).

Illustrations: Saunders (1961, pl. 1); Vollesen (1987, fig. 1B); Dariev & Abdullaev (1985, fig. 56).

34. ***Gossypium anomalum* subsp. *senarensis* (Wawra & Peyritsch)** Vollesen, Kew Bull. 42: 339. 1987.

Gossypium senarensis Fenzl ex Wawra & Peyritsch, Sitzungsber. Akad. Wiss. Nat.-Math. Cl. Wien 38: 562. 1860.

Type: Ethiopia, Kotschy 90 (holotype: W; isotype: K).

Interpretation of *Gossypium*

Gossypium herbaceum var. *steudneri*
Schweinfurth ex Gurke, Bot. Jahr.
Syst. 19 (Beibl. 48): 2. 1894,
pro syn.

Gossypium anomalum var. *steudneri*
Schweinfurth ex Roberty, Candollea
13: 27. 1950.

Type: Abyssinia. Bei Seban auf
der Seite nach dem Barka Zu,
Steudner 1134 (B-destroyed).

Subspecies *senarensis* is distinguished from subsp. *anomalum* primarily on the basis of pubescence differences, as noted in the Key and as discussed more fully by Vollesen (1987). The two subspecies are also clearly allopatric in distribution.

Distribution: Niger, Chad, Sudan, and Ethiopia (see map 1 in Vollesen, 1987).

35. *Gossypium capitis-viridis* Mauer,
Trudy Sredne Aziatsk. Gosud. Univ.
Lenina n. s. 18: 19. 1950.

Type: Cape Verde Islands, Sao
Tiago, *Stewart 63* (holotype: LE).

Gossypium barbosanum Phillips &
Clement, Bot. Mus. Leaflet. 20:
214. 1963.

Type: In cultivation, seeds from
Monte do Trigo, near Tarrafal, Ilha
de Santa Antao, Cape Verde Islands,
Phillips & Clement 891 (lectotype:
ECON; isotype: US).

Shrubs 1-2.5 m tall, the stems
stellate-pubescent (densely canescent
when young), punctate. Leaves petio-
late, pedately 7-9-nerved, deeply 5-7-

lobed, the lobes ovate, basally constricted (the sinuses closed), the central lobe itself sometimes irregularly lobed, entire, acuminate, stellate-pubescent above and beneath, with 1-3 inconspicuous foliar nectaries beneath on principal veins; stipules 4-7 mm long, subulate. Flowers and fruits solitary in the leaf axils or borne on sympodial inflorescences, the pedicels 5-12 mm long, with pubescence like that of stem, surmounted by 3 involucellar nectaries; bracts of the involucre 3, inserted above the nectaries, deeply 3-parted, 15-18 mm long; calyx 7-10 mm long, 5-lobed, the lobes acute to acuminate, stellate-pubescent, punctate, the calyx abscising circumscissally at base and more or less deciduous in fruit; petals 2.5-3 cm long, yellow with dark red spot at base, sparsely and minutely punctate; staminal column pallid, glabrous, non-glandular, ca. 10 mm long, the filaments 1 mm long; style exceeding androecium, sparsely punctate, the stigmatic lobes decurrent. Capsules ovoid, beaked, 15-20 mm long, 3-5-loculed, glabrous, prominently punctate, the glands few, raised, ca. 0.5 mm in diameter; seeds ca. 6 mm long, densely pubescent, the fibers brownish, appressed.

Distribution: Cape Verde Islands (see map in Anonymous 1968, fig. 2; map 2 in Holubec, 1990).

Illustrations: Dariev & Abdullaev (1985, fig. 58).

Vollesen (1987) merged *G. capitis-viridis* in *G. anomalum* subsp. *senarensis*, focussing his attention on the degree of leaf lobing. However, several other characters serve to distinguish the Cape Verde cotton from the continental plants

(see key), including the distinctive circumscissally dehiscent calyx. The reasons for reducing *G. barbosanum* to synonymy with *G. capitis-viridis* are elaborated by Fryxell (1984), but are not accepted by Dariev & Abdullaev (1985).

Subgenus *Gossypium*

Section *Gossypium*

Subsection *Pseudopambak* (Prokhanov) Fryxell, Nat. Hist. Cotton Tribe 65. 1979.

Type: *Gossypium stocksii* Masters.

Erect or decumbent subshrubs or shrubs with pubescent to glabrate foliage; stems punctate, tomentose; leaves more or less lobed, the margins entire; involuellar bracts ligulate to broadly ovate, entire to lacinate, persistent; corolla yellow with dark center; seeds exarillate, appressed-pubescent.

The seven species of subsection *Pseudopambak* occur in arid to extremely arid habitats in eastern Africa and the southeastern end of the Arabian Peninsula, extending to Sind in Pakistan, sometimes in seasonally dry stream beds. Dariev & Valicek (cited in Dariev & Abdullaev, 1985) restricted subsection *Pseudopambak* to the single species, *G. stocksii* and proposed subsection *Erecta* Dariev & Valicek (Agric. Trop. Subtrop. 12: 157 1979) to include *G. areysianum*, *G. incanum* (as type), *G. somalense*, and *G. ellenbeckii*.

Note: Descriptions of some of the following species (especially *G. bricchettii* and *G. benadirensis*) are incomplete as a result of the unavailability of adequate

material on which to base more complete descriptions.

36. *Gossypium stocksii* Masters in Hooker, Fl. Brit. India 1: 346. 1874.

Type: Pakistan. Karachi, limestone rocks on the coast of Sind, *Stocks* 469 (holotype: K).

Decumbent or trailing shrubs, the stems softly tomentose, punctate. Leaves petiolate, cordate, broadly rotund in outline, pedately 7-9-nerved, moderately 5-lobed, the lobes entire, rounded-apiculate, the sinuses mostly closed, obscurely pubescent to glabrate, punctate (obscurely so above), with a single inconspicuous foliar nectary beneath; stipules subulate, 5-8 mm long, caducous. Flowers and fruits borne on short (1-2-flowered) sympodial inflorescences, the pedicels slender, 5-10 mm long, surmounted by 3 involuellar nectaries; bracts of the involuellar inserted above the nectaries, cuneate-elliptic, 7-9-lacinate, 15-20 mm long, 7-9 mm wide, pubescent, punctate; calyx 6-7 mm long, pubescent; punctate, 5-lobed, the lobes acuminate, the sinuses rounded; petals 25 mm long, yellow with red spot at base, epunctate or nearly so, pubescent externally especially where exposed in bud, glabrous internally; staminal column labrous, pallid, epunctate or sparsely punctate, the filaments up to 1 mm long, the pollen yellow; style exceeding the staminal column, punctate. Capsules subglobose, beaked, 3-loculed, punctate; seeds 6 mm long, densely pubescent, the fibers brownish, appressed.

Distribution: Somalia, Oman, and Pakistan (see map in Anonymous 1968,

fig. 2; map 2 in Vollesen, 1987, map 3 in Holubec, 1990).

Illustrations: Watt (1907, fig. 6); Saunders (1961, pl. 14), reprinted by Fryxell (1979, fig. 26); Valicek (1979, figs. 76, 77); Vollesen (1987, fig. 1F); Dariev & Abdullaev (1985, fig. 61).

37. ***Gossypium areysianum*** Deflers, Esq. Geogr. Bot. 49. 1894.

Fugosia areysiana (Deflers) Deflers, Bull. Soc. Bot. France 42: 299. 1895.

Gossypium anomalum subsp. *areysianum* (Deflers) Roberty, Candollea 13: 27. 1950.

Type: Ad declivia australia petraea montis el-'Areys (Bilad Fodhli), 700-800 m, *Deflers 1058* (holotype: P).

Shrubs 0.5-1.5 m tall (to 3 m according to Hearn, 1968), the stems minutely puberulent and obscurely punctate. Leaves petiolate, cordate, broadly rotund-ovate and weakly 3-lobed, entire, rounded-acute or acuminate, usually wider than long, pedately 7-nerved, sparsely pubescent to glabrate, with an obscure foliar nectary near base of midrib beneath; stipules linear-falcate, 5-15 mm long, caducous. Flowers and fruits borne on short (usually 1-2-flowered) sympodial inflorescences, the pedicels slender, 5-10 mm long, surmounted by 3 involuellar nectaries; bracts of the involucler inserted above the nectaries, ligulate, 10-15 mm long, 1-2 mm wide, entire or irregularly tritid apically, punctate; calyx 6-8 mm long, punctate, shallowly 5-lobed, the sinuses rounded; petals 20-25 mm long, yellow with dark

red spot at base, epunctate, pubescent externally especially where exposed in bud; staminal column 10-15 mm long, pallid, glabrous, the filaments subsessile or up to 0.5 mm long, the anthers reddish; style exceeding the androecium, punctate. Capsules ovoid, 3-loculed; seeds 6-7 mm long, densely pubescent, the fibers brownish-gray, appressed.

Distribution: South Yemen (see Table 1 and map in Hearn, 1968; and map 3 in Vollesen, 1987).

Illustrations: Saunders (1961, pl. 16); Fryxell (1979, fig. 27); Valicek (1979, figs. 78, 79); Vollesen (1987, fig. 1D); Dariev & Abdullaev (1985, fig. 62).

Hearn (1968) states that *G. areysianum* occurs in two distinct habitats. On the one hand, it is found in rocky water courses and at the base of cliffs and rock outcrops, where there is almost no other vegetation. On the other hand, it also occurs in deep alluvial soils downstream from the former sites, near sea level.

38. ***Gossypium somalense*** (Gurke) J. B. Hutchinson, *Evol. Gossyp.* 31. 1947.

Cienfuegosia somalensis Gurke, Bot. Jahrb. Syst. 33: 380. 1903.

Type: Somalia, am Flussufer in Fullathal, *Ellenbeck 220* (holotype: B-destroyed).

Cienfuegosia ellenbeckii Gurke, Bot. Jahrb. Syst. 33: 381. 1903.

Gossypium ellenbeckii (Gurke) Mauer, *Trudy Sredne-Aziatsk Gosud. Univ. Lenina n.s.* 18: 19. 1950.

Types: Ethiopia. Gallahochland, bei Tarro Gumbi im Lande Boran, *Ellenbeck 2069 & 2082* (syntypes: B-destroyed).

Gossypium paolii Mattei, Boll. Stud. Inform. R. Giord. Palermo 2(4): 223. 1916.

Type: Somalia. presso Salagle, sulla riva inglese del Giuba, 4 Jul. 1913, *Paoli s.n.* (holotype: FT).

Shrubs to 1.5 m tall, the stems stellate-tomentose. Leaves petiolate, more or less rotund, cordate, shallowly 3-lobed, entire, pedately 5-7-lobed, the lobes acute to obtuse (sometimes mucronate), stellate-tomentose above and beneath, with an obscure foliar nectary on midrib beneath; stipules 6-7 mm long, subulate, caducous. Flowers and fruits borne on short (1-2-flowered) sympodial inflorescences, the pedicels 6-12 mm long, bracteate at articulation, surmounted by 3 involuellar nectaries; bracts of the involucl inserted above the nectaries, broadly ovate and deeply cordate, narrowed to a very short claw, 2-3 cm long, 3-3.5 cm broad, coarsely 5-13-dentate, tomentose, obscurely punctate; calyx 5-7 mm long, undulately 5-lobed, somewhat tomentose, with scattered black glands, the lobes obtuse; petals ca. 2 cm long (subequal to involucl), yellow with prominent dark red spot at base, epunctate or nearly so, pubescent externally especially where exposed in bud, glabrous internally; staminal column pallid, glabrous, epunctate, the anthers subsessile or the filaments to 1 mm long; style exceeding the androecium, punctate. Capsules ovoid, beaked, 1 cm long, 3-4-loculed, more or less appressed-hirsute, punctate, pubescent on

inner suture line, the hairs 2 mm long, included in persisting involucl; seeds solitary, ca. 7 mm long, densely pubescent, the fibers brownish, appressed.

Distribution: Niger, Chad, Sudan, Ethiopia, Somalia, Uganda, and Kenya (see map in Anonymous 1968, fig. 2; map 3 in Vollesen, 1987; map 3 in Holubec 1990).

Illustrations: Saunders (1961, pl. 15); Valicek (1979, figs. 82, 83); Vollesen (1987, fig. 2C); Dariev & Abdullaev (1985, figs. 64, 65).

39. *Gossypium bricchettii* (Ulbrich) Vollesen, Kew Bull. 42: 349. 1987.

Cienfuegosia bricchettii Ulbrich, Bot. Jahrb. Syst. 48: 378. 1912.

Type: Somalia, *Robecchi-Bricchetti 338* (holotype: FT).

Branched shrubs to 2.5 m tall, the young stems stellate-tomentose. Leaves petiolate, ovate, unlobed or more or less 3-lobate (the lobes ovate), acute to mucronate, basally shallowly cordate, pedately 5-7-veined, with foliar nectary on midrib beneath; stipules 4-13 mm long, subulate, caducous. Flowers mostly solitary or on short sympodial inflorescences; pedicels 5-8 mm long, bracteate at articulation, with 3 involuellar nectaries; bracts of involucl inserted above the nectaries, broadly ovate, deeply cordate, 5-9-dentate, stellate-tomentose, obscurely punctate; calyx 4 mm long, cupuliform, truncate (or undulate with obtuse lobes), stellate-tomentose, epunctate; petals ca. 2 cm long, yellow with dark red spot at base, externally stellate-tomentose, internally glabrous. Capsules

Interpretation of *Gossypium*

ovoid, acuminate, tapering to a long beak, 4-5-loculed, densely hirsute or strigose with appressed hairs, punctate, glabrous on inner suture line; seeds solitary or paired in the locules, 5-7 mm long, 3 mm wide, densely lanate, with appressed brownish hairs to 8 mm long.

Distribution: Somalia (see map 3 in Vollesen, 1987; map 3 in Holubec, 1990).

Illustrations: Vollesen (1987, fig. 2B).

40. *Gossypium benadirens* Mattei, Boll. Stud. Inform. R. Giord. Colon. Palermo 2: 223. 1916.

Type: Somalia. nei dintorni di Lugh., 26 Oct. 1913, *Paoli* s. n. (holotype: FT).

Erect shrubs to 2.5 m tall, the stems stellate-tomentose. Leaves petiolate, broadly ovate, simple or shallowly trilobate, acute, pedately 5(-7)-veined, basally rotund to shallowly cordate, the lobes rotund, stellate-tomentose, with an obscure foliar nectary on the midrib beneath; stipules 5-7 mm long, subulate, caducous. Flowers on short sympodial inflorescences; pedicels 8-12 mm long, bracteate at articulation with 3 involucellar nectaries; bracts of the involucler inserted above the nectaries, broadly cordate, obtuse, entire, stellate-tomentose, epunctate; calyx cupuliform, truncate to sinuate-lobate, epunctate; petals ca. 2 cm long, yellow with reddish cast, with dark red spot at base, externally stellate-tomentose. Capsules 5-loculed, strigose.

Distribution: Ethiopia, Somalia, and Kenya (see map 4 in Vollesen, 1987; map 3 in Holubec, 1990).

Illustrations: Vollesen (1987, fig. 2A).

41. *Gossypium incanum* (Schwartz) Hillcoat, Empire Cotton Growing Rev. 36: 165. 1959.

Cienfuegosia incana Schwartz. Mitt. Inst. Allg. Bot. Hamburg 10: 165. 1935.

Type: Arabia. South Yemen, Hadramaut, in der Umgebung von Nischataun bei Ras Fartali, *Paulay* s. n. (holotype: W).

Sparsely branched shrubs 1-1.5 m tall (up to 3 m according to Hearn, 1968), the stems stellate-tomentose. Leaves petiolate, oblong-ovate to shallowly 2-3-lobed, basally truncate or subcordate, palmately 5-7-nerved, entire, abruptly acuminate, softly tomentose above and beneath, the foliar nectary obscure; stipules subulate 6-8 mm long, 1 mm wide, caducous. Flowers and fruits borne on short (usually 1-2 flowered sympodial inflorescences, the pedicels slender, 6-14 mm long, bracteate at articulation, surmounted by 3 involucellar nectaries; bracts of the involucler inserted above the nectaries, ovate, narrowed to a short claw, 2-3 cm long, 1-2 cm wide, distally 5-11-toothed, tomentose, obscurely punctate; calyx ca. 10 mm long, pubescent, obscurely punctate, 5-lobed, the lobes ovate-acuminate; petals 25 mm long, yellow with a dark red spot at base, minutely punctate distally, pubescent externally especially where exposed in bud, ciliate on claw, glabrous internally; staminal column glabrous, pallid, epunctate, ca. 1 cm long, the anthers subsessile or the filaments up to 1 mm long; style exceeding the androecium, punctate. Capsules ovoid, beaked, 10 mm long, 3-loculed, glabrous, gland-dotted; seeds ca. 4 mm long, densely pubescent, the fibers tan, appressed.

Distribution: South Yemen (see Table 1 and map in Hearn, 1968; map 3 in Vollesen, 1987; map 3 in Holubec, 1990).

Illustrations: Saunders (1961, pl. 17); Valicek (1979, figs. 80, 81); Vollesen (1987, fig. 2D); Dariev & Abdullaev (1985, fig. 63).

According to Hearn (1968), *G. incanum* is confined to coastal areas of southern Yemen "in beds or banks of sand rivers subject to flash floods."

42. ***Gossypium vollesenii*** Fryxell, sp. nov. *G. sp. A*, *sensu* Vollesen, Kew Bull. 42: 347. 1987.

Type: Somalia. 37 km E of Lad Anod (8°28'N, 47°42'E), 610 m, 18 Nov 1980, *Hemming & Watson 3156* (holotype: K).

Sufrutices scandentes puberulenti; foliis pedatim 5-7-nerviis; bracteis involucellorum epunctatis longioribus quam latoribus, laciniatis; calycibus 4-6 mm longis, epunctatis, irregulariter 5-dentatis; capsulis 1.5 cm longis, valde punctatis, parce strigosis; seminibus 2 per loculis.

Scandent subshrub to 2.5 m tall, the stems arachnoid-puberulent, with widely scattered gossypol glands. Leaf blades ovate to shallowly 3-lobed, basally cordate, entire, apiculate, 2-3.5 cm long, 2.5-3.5 cm wide, pedately 5-7-nerved (the nerves raised beneath and with sparse gossypol glands), softly arachnoid-puberulent above and beneath, with 1-3 nectaries on the principal veins near base of blade, the nectaries somewhat obscured by pubescence; petioles 1-2 cm

long, with pubescence like stem; stipules subulate, 5-7 mm long, puberulent. Flowers in sympodial inflorescences with 2 (sometimes 3) flowers; pedicels 5-8 mm long, with broad stipuliform bracts at articulation, with pubescence like stem, surmounted by 3 sunken nectaries 2 mm long; involucellar bracts 3, ovate and prominently veined, minutely stellate-pubescent, essentially epunctate, 18-25 mm long, 14-16 mm wide, distally 5-9-lacinate; calyx 4-6 mm long, epunctate minutely stellate-pubescent and marginally ciliate, irregularly 5-toothed; corolla yellow with dark red center, funnelform, 2-2.5 cm long; genitalia included, Capsules 1.5 cm long, 10-12 mm in diameter, ovoid-apiculate, prominently gland-dotted, sparsely appressed-strigose (hairs 0.5 mm long), 3-loculed, internally with long fine hairs along suture of dehiscence; seeds 2 per locule, 5-6 mm long, densely pubescent, the hairs tan, tightly curled against seed surface, when teased away from seed ca. 5 mm long.

Vollesen (1987, p. 347) states "This species superficially resembles *G. incanum* from Yemen but has a much larger hairy capsule with 2-seeded locules. It also produces 2-4-flowered inflorescences whereas the flowers are always 1-flowered cymes in *G. incanum*. Of the 5 calyx teeth, 1 or 2 are triangular acute teeth distinctly longer than wide, while the other three are broader than wide and approach the broadly rounded or almost obsolete teeth of [*G. somalense*]. More material is needed of this plant before it can be confidently described as a new species." He indicates the locality in map 4, and provides comparative drawings of *G. incanum* and "sp. A" of leaf, calyx, fruit, and bract.

It is evident from Vollesen's description and comparative drawings as well as from the allopatric distribution, that this species is distinct from *G. incanum* and merits recognition as such. Study of the type reveals additional characters to distinguish *G. vollesenii* and *G. incanum*, as indicated in the key. Although *G. vollesenii* superficially resembles *G. incanum*, it also shares certain characters with *G. somalense*, notably the epunctate involucellar bracts, the strigose fruits, and the pedate venation of the leaves.

The collectors of the type specimen indicate the habitat as "a varied site: gypseous plain, gypseous hill-slopes, planed limestone and stone-mantles, and a water-course incised 3 m into stone anhydrite." They describe the plant as a "weak woody stemmed plant to 2.5 m supported by *Cadaba heterotriche*."

Distribution: Somalia (see map 4 in Vollesen, 1987).

Illustrations: Vollesen (1987, fig. 2E).

Subgenus *Gossypium*

Section *Gossypium*

Subsection *Longiloba* Fryxell, Taxon 18: 590: 1969.

Type: *Gossypium longicalyx* Hutchinson & Lee

Scandent shrubs with sparsely pubescent to glabrate foliage; stems prominently punctate, glabrate; leaves unlobed, the margins entire; involucellar bracts ovate, entire, persistent; corolla yellow without dark center; seeds exarillate, appressed-pubescent.

Subsection *Longiloba* is monotypic and occurs in East Africa in relatively more mesic habitats than is usual for other species of the genus.

43. *Gossypium longicalyx* J.B. Hutchinson & Lee, Kew Bull. 1958: 221. 1958.

Type: Tanzania. Dodoma District, Nondwa, in *Terminalia-Combretum* scrub, below 900 m, 25 Mar 1955, Disney 33 (holotype: EA; isotype: K).

Scandent shrubs usually supported by other vegetation, the stems sparsely pubescent to glabrate, prominently gland-dotted. Leaves petiolate, ovate, truncate to cordate, entire, palmately 7-nerved, acuminate, gland-dotted, with an inconspicuous foliar nectary on midrib beneath; stipules 4-8 mm long, 1-4 mm wide, acuminate, caducous. Flowers and fruits borne on sympodial inflorescences, the pedicels 8-20(-30) mm long, sparsely pubescent and gland-dotted; involucellar nectaries lacking; bracts of the involucre ovate-cordate, entire, acute to acuminate, gland-dotted, 15-20 (-30) mm long, almost as broad; calyx 8-12 mm long, prominently gland-dotted, deeply divided, the lobes narrowly triangular; petals 15-20 mm long, yellow, minutely gland-dotted, ciliate on claw, pubescent externally where exposed in bud, glabrous internally; staminal column pallid, glabrous eglandular, 8-9 mm long, the filaments 1-2 mm long; style exceeding the androecium. Capsules ovoid, 10-15 mm long, 3-loculed, gland-dotted, somewhat pubescent; seeds 2-3 per locule, 5-6 mm long, densely pubescent, the fibers grayish, appressed.

Distribution: Sudan, Uganda, and Tanzania (see map in Anonymous 1968, fig. 2, map 4 in Vollesen, 1987; map 3 in Holubec, 1990).

Illustrations. Saunders (1961, pl. 18); Fryxell (1979, fig. 28); Valicek (1979, figs. 85, 86); Vollesen (1987, fig. 1E); Dariev & Abdullaev (1985, fig. 66).

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Section *Triphylla* (Prokh.) Fryx., stat. nov., Basionym: *Gossypium* subsection *Triphylla* Prokhanov, Bot. Zhurn. 32: 66. 1947.

Type: *Gossypium triphyllum* (Harvey) Hochreutiner.

Subshrubs with puberulent foliage; stems obscurely punctate, tomentulose; leaves trifoliolate, the margins entire; involuellar bracts ligulate, reflexed, persistent; corolla pale yellow suffused with lavender with dark center; seeds axillate, appressed-pubescent.

Section *Triphylla* is monotypic, and its single species occurs in extremely arid habitats in southwestern Africa.

44. ***Gossypium triphyllum*** (Harvey & Sonder) Hochreutiner, Bull. Herb. Boiss. 2: 1004. 1902.

Fugosia triphylla Harvey ex Harvey & Sonder, Fl. Cap. 2: 588. 1862.

Cienfuegosia triphylla (Harvey & Sonder) Schumann, Bot. Jahrb. Syst. 10: 47. 1889.

Gossypium anomalum subsp. *triphyllum* (Harvey & Sonder) Roberty, Candollea 13: 26. 1950.

Type: Damaraland. *Elliott s. n.* (holotype: TCD; isotype: KMG?).

Slender much-branched shrubs, the stems stellate-tomentose, obscurely punctate. Leaves short-petiolate, palmately trifoliolate, the leaflets narrowly elliptic, entire, basally and apically acute, with a

single principal nerve, obscurely punctate especially on margins, tomentose, the foliar nectaries 1-3, obscure; stipules subulate, 2-4 mm long, tomentose, caducous. Peduncles axillary, 1-flowered, tomentose, obscurely punctate, articulated 5-20 mm below the flower, bracteate at articulation, the pedicel surmounted by 3-involucellar nectaries; bracts of the involucler inserted above the nectaries, triangular to ligulate, sometimes apically 3-dentate, tomentose, more or less reflexed, 7-9 mm long; calyx 6-8 mm long, tomentose, punctate, 5-lobed, the lobes acuminate, the sinuses rounded; petals 3 cm long, pale yellow suffused with lavender, with dark purple spot on lower half, punctate, externally pubescent where exposed in bud, internally glabrous; staminal column glabrous, pallid or somewhat purplish, sparsely punctate at base, the filaments ca. 1 mm long; slender, exceeding the androecium, epunctate or nearly so. Capsules ovoid, beaked, 3-lobed, densely pubescent; seeds 6-7 mm long, densely pubescent, the fibers creamy-tan, appressed.

Distribution: Angola, Botswana, and Namibia (see map 3 in Vollesen, 1987; map 3 in Holubec, 1990).

Illustrations: Saunders (1961, pl. 2); Valicek (1979, figs. 72, 73); Vollesen (1987, fig. 1A); Dariev & Abdullaev (1985, fig. 59).

Vollesen (1987) and others consider *G. triphyllum* to have its nearest affinity to *G. anomalum*, based on their common occurrence on the African continent and on the fact that "artificial hybrids show a certain degree of fertility." On the other hand, I placed the species in section *Hibiscoidea* (Fryxell, 1979) on the

basis of morphological similarities, including corolla pigmentation, fruit pubescence, (cf. *G. australe*), calyx form, and a similar sort of leaf dissection (cf. *G. bickii*). Wendel & Albert (1992) have shown a close phylogenetic relationship of *G. triphyllum* with *G. anomalum* and *G. capitiviridis* on the basis of cpDNA studies, but this evidence is not wholly persuasive in view of the similar results obtained by them for *G. cunninghamii* and *G. aridum*, where the latter species are placed in the phylogenetic diagram in a position that is contrary to all other forms of evidence. What are needed to resolve this problem are hybridization studies between *G. triphyllum* and the other species in question to evaluate the relative genetic and phylogenetic affinities based on nuclear DNA complements.

Subgenus *Gossypium*

Section *Serrata* Fryxell, sect. nov.

Type: *Gossypium trifurcatum* Vollesen. Ab omnibus ceteris speciebus *Gossypii* foliis non lobatis grossedentatis differt.

Shrubs with tomentulose foliage; stems obscurely punctate, tomentulose; leaves unlobed, serrate; involucellar bracts linear, divided, persistent; corolla pale yellow (fading reddish) with dark centre; seeds exarillate, pubescent.

Holubec (1990) pointed out that *Gossypium trifurcatum* probably deserves to be set apart at the sectional level, which is here done. Section *Serrata* is monotypic and occurs in desert habitats in eastern Somalia. It is distinguished from the remainder of the genus by its dentate leaves, and there is the possibility, on that account, that this species pertains to the genus *Cienfuegosia* rather

than *Gossypium*. The possibility needs to be considered when further material is available for study, but for the present *G. trifurcatum* is retained in *Gossypium*, and section *Serrata* is erected to accommodate it.

45. *Gossypium trifurcatum* Vollesen, Kew Bull. 42: 342. 1987.

Type: Somalia. *Hemming 1822* (holotype: K; isotype: EA).

Shrubs to 1 m tall, the stems stellate-tomentulose becoming glabrate. Leaf blades 3.5-4 cm long, broadly ovate, basally subcordate, coarsely dentate, palmately 5-7-nerved (the main veins terminating in the teeth at the margin), acute to rounded, stellate-tomentulose above and beneath; petioles 2-4 mm long; stipules 2-4 mm long, subulate to linear. Flowers in 1-flowered axillary cymes (often 1-2 extra buds present but these abort at an early stage); pedicels 1-3 mm long, subtended by foliaceous bracts; [involucellar nectaries?]; bracts of the involucler linear, each deeply divided into 3 linear lobes (the 2 lateral lobes sometimes with 2 small additional teeth near base), the middle lobe 6-12 mm long, the lateral lobes 2-6 mm long, tomentulose, punctate (but glands somewhat hidden by tomentum); calyx 5-7 mm long, punctate, with 5 triangular acuminate, teeth ca. 2 mm long, each with a prominent midrib and 2 weaker commissural veins; corolla funnelform, pale yellow fading reddish, with dark maroon centre, the external margin exposed in bud pink, the petals 1.5-2 cm long with irregularly crenulate distal margin; staminal column ca. 7 mm long, the stamens subsessile; style exceeding androecium by ca. 1 cm, punctate. Capsules ca. 8 mm long, glabrous apically

retuse, punctate, the glands raised; seeds solitary, brown-pubescent.

Distribution: Easternmost Somalia (see map 4 in Vollesen, 1987; map 2 in Holubec 1990).

Illustrations: Vollesen (1987, fig. 1C).

Subgenus *Karpas* Rafinesque, *Sylva Tellur.* 14. 1838.

Type: *Gossypium guyanense* Rafinesque [= *Gossypium barbadense* L.].

Shrubs or small trees with pubescent to glabrate foliage; stems punctate, pubescent to glabrate. Leaves more or less lobed, the margins entire. Involucellar bracts ovate, laciniate, persistent; corolla cream-colored to bright yellow, with or without a dark centre. Seeds exarillate, pubescent often with long fibre (cotton).

Subgenus *Karpas* includes the tetraploid species of *Gossypium*, including both wild and cultivated species. It does not seem possible to subdivide the subgenus in any reasonable way into sections or subsections, and so no subdivisions are proposed. It is also difficult to characterize the subgenus ecologically since the several species occur in a wide range of habitats. They are best considered individually.

46. ***Gossypium mustelinum*** Miers ex Watt, *Wild Cult. Cotton* 167. 1907. *Gossypium hirsutum* f. *mustelinum* (Watt) Roberty, *Candollea* 7: 330. 1938.

Gossypium hirsutum subsp. *mustelinum* (Watt) Roberty, *Candollea* 13: 60. 1950.

Type: Brazil, Ceara, *Gardner 1463* (holotype: BM; isotypes: CGE, GH, K, NY).

Gossypium caicoense Aranha et. al., *Bragantia* 28: 274. 1969.

Type: Brazil. Rio Grande do Norte, Serra da Formiga, Município de Caico, *Aranha, Leitao & Gridi-Papp* s.n. (holotype: IAC).

Shrubs or small trees to 5 m tall, the stems stellate-tomentose. Leaves petiolate, cordate, 3-5-lobed, the lobes ovate, entire, acuminate, densely soft-tomentose, obscurely punctate, with 1-3 inconspicuous foliar nectaries beneath; stipules 10-12 mm long, subulate to falcate, caducous. Flowers and fruits borne on sympodial inflorescences, the pedicels densely tomentose, punctate, surmounted by 3 involucellar nectaries; bracts of the involucler inserted above the nectaries, ovate, ca. 25 mm long, 16 mm wide, 9-17-laciniate, externally tomentose, internally glabrate, with 3 additional nectaries at the juncture of involucler and calyx, alternate with the bracts; calyx 5-6 mm long, punctate, glabrous, except ciliate on margin, undulate or subtruncate; petals 4-4.5 cm long, yellow with dark red spot at base, minutely punctate, externally pubescent, internally glabrous; staminal column 18 mm long, punctate, pallid, glabrous; style exceeding androecium, punctate. Capsules 3-4-loculed, glabrous, narrowly ovoid, beaked, punctate, the glands raised; seeds bearing sparse brownish fibres.

Distribution: Northeastern Brazil (see maps in Pickersgill et. al. 1975, figs. 1 and 6),

Illustrations: Watt (1907, fig. 26); Pickersgill et. al. 1975, fig. 3); Valicek (1987, figs. 98, 99); Dariev & Adbullaev (1985, figs. 75, 76).

47. ***Gossypium tomentosum* Nuttall**
ex Seemann, Fl. Vitiensis 22. 1885.

Hibiscus tomentosus (Seemann)
Kuntze, Revis. Gen. Pl. 1: 68. 1891.

Gossypium hirsutum f. *tomentosum*
(Seemann) Roberty, Candollea 13:
73. 1950.

Type: Hawaii, *Nuttall s.n.* (lecto-
type: BM; isoelectotype: PH).

Gossypium sandvicense Parlatore,
Sp. Coton. 37. t. 6. 1866.

Type: Hawaii, *Menzies s.n.* (lecto-
type: FI).

Gossypium tomentosum var. *parvi-
folium* Nuttall ex Watt, Wild Cult.
Cotton 71. 1907.

Type: Hawaii, *Diell s.n.* (holo-
type: BM).

Shrubs 1-2 m tall, the stems minutely tomentose, obscurely punctate. Leaves petiolate, deeply cordate, moderately 3-5-lobed, pedately 7-9-nerved, densely and minutely tomentose above and beneath, the lobes ovate, entire, acute or acuminate, the foliar nectary absent; stipules subulate, tomentose, 7-8 mm long, caducous. Flowers and fruits borne on sympodial inflorescences; the pedicels 1.5-3 cm long, tomentose, obscurely punctate, the involucellar nectaries absent; bracts of the involucre ovate, apically 3-9-dentate, tomentose, 12-18 mm long, 9-12 mm wide; calyx 5-7 mm long, prominently punctate, subtruncate to 5-undulate; petals yellow and shiny (internally) when fresh but often drying brownish and dull, minutely punctate, externally pubescent, especially where exposed in bud;

staminal column 9-12 mm long, glabrous, pallid, epunctate, the filaments 6-9 mm long; style exceeding the androecium, subequal to petals, slender, punctate or epunctate. Capsules globose or ovoid, beaked, 3(-4)-loculed, 1.5(-2) cm long, glabrous, prominently punctate; seeds ca. 7-8 mm long, copiously pubescent, the fibres reddish-brown.

Distribution: Endemic to the Hawaiian Archipelago.

Illustrations: Watt (1907, fig. 5); Valicek (1987, figs. 95, 96); Dariev & Abdullaev (1985, fig. 73, 76).

Dejode & Wendel (1992?) presented data indicating that *G. tomentosum* is more closely allied to *G. hirsutum* than to any other of the tetraploid species. This relationship conforms to the hypothesis that *G. tomentosum* had its origin by trans-oceanic dispersal from the neotropics.

The nomenclature and typification of this species were established by Fryxell (1972, 1978a). For a contrary view, see Wilbur (1964, 1977, 1981).

48. ***Gossypium barbadense* Linnaeus**,
Sp. Pl. 693. 1753.

Hibiscus barbadensis (Linnaeus)
Kuntze, Revis. Gen. Pl. 1: 67. 1891.

Lectotype: Plukenet's plate, t. 188:
f. 1. (Phytographia, 1692).

More than a dozen synonyms are
cited by Fryxell (1979, 1988),

Shrubs 1-3 m tall, sometimes arborescent, sparsely stellate-pubescent to glabrate. Leaf blades mostly 8-20 cm long, 3-7 lobed (less than half-divided),

the lobes ovate to lanceolate; petioles 1/3-3/4 the length of the blades; stipules 1-5 cm long, often prominent, subulate to falcate. Flowers solitary in the leaf axils or in sympodial inflorescences; involucellar nectaries generally prominent; bracts of the involucre 4-6 cm long, broadly ovate, cordate, foliaceous, 5-17-laciniate, persistent; calyx 8-10 mm long, truncate; corolla usually yellow with a dark red centre, the petals up to 8 cm long; staminal column 2.5 cm long; style exceeding androecium. Capsules 3.5-6 cm long, usually narrowly ovoid, to elongate, 3-loculed, glabrous, prominently pitted; seeds 8-10 mm long, several per locule, free or fused together, lanate, the seed hairs (cotton) usually white.

Distribution: Originally South American, now widely distributed in cultivation to many other parts of the world.

Illustrations: Watt (1907, figs. 37-38, 45-50); Martius (Fl. Bras. 12(3): pl. 114); Valick (1979, figs. 91, 92).

Percy & Wendel (1990) have concluded that northwestern South America is the "ancestral home" of the species and have used evidence from allozyme variability to trace its dispersal to other parts of South America and other parts of the world, and have detected appreciable introgression from *G. hirsutum* in certain parts of this range.

49. *Gossypium darwinii* Watt; Wild Cult. Cotton 68. 1907.

Gossypium barbadense var. *darwinii* (Watt) J. B. Hutchinson, Evol. Gossyp. 51. 1947.

Gossypium barbadense subsp. *darwinii* (Watt) Mauer, Truny Sredne-

Aziatsk. Gosud. Univ. Lenina n. s. 18(7): 24. 1950.

Gossypium barbadense f. *darwinii* (Watt) Roberty, Candollea 13: 91. 1950.

Type: Galapagos Archipelago, James Island, 1835, *Drawin s. n.* (holotype: CGE).

Shrubs 1-3 m tall, the stems slender, slightly angular, prominently punctate, stellate-pubescent to glabrate. Leaves petiolate, cordate, 3-5-lobed (rarely unlobed), palmately 7-nerved, punctate, the lobes ovate, entire, acuminate, sparsely pubescent with an inconspicuous foliar nectary on midrib beneath; stipules subulate to falcate, 6-10 mm long. Flowers solitary or in sympodial inflorescences; pedicels to 2 cm long; involucellar bracts ovate, 2.5-5 cm long, laciniate; calyx truncate, to 1 cm long; petals yellow with dark basal spot, 4-8 cm long; androecium shorter than the corolla. Capsules 3-loculed, mostly 2-2.5 cm long, with a pitted surface, narrowly ovoid, apically acuminate; seeds with brownish or white fibres.

Distribution: Endemic to Galapagos Archipelago.

Illustrations: Watt (1907, fig. 4).

Bates (in Wiggins & Porter 1971) notes that this plant is polymorphic within the Galapagos Archipelago in leaf form and pubescence and presumably in other characters as well.

Gossypium darwinii has been variously recognised in specific rank or in infraspecific rank within *G. barbadense*. Admittedly, the rank to be utilized in this

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instance is arbitrary and a matter of taxonomic opinion, I prefer to retain these plants in specific rank in recognition of their ecological distinctiveness. *G. darwinii* is a part of the indigenous flora of the Galapagos Archipelago, whereas *G. barbadense* is essentially confined to cultivation. They are, moreover, distinguishable morphologically. In addition, and even more persuasively, Wendel & Percy (1990) have presented a comprehensive analysis of allozyme data that supports the recognition of *G. darwinii* in specific rank.

I recognize that they are interfertile and can easily be hybridized and that there is evidence of introgression of germplasm from *G. barbadense* into *G. darwinii* (Wendel & Percy 1990). However, in *Gossypium* the ease of interbreeding and the vigour of the hybrid are a poor measure of the genetic barriers that may separate taxa. To evaluate these barriers, better it is necessary to evaluate genetic breakdown (or the lack of it) in advanced generations beyond the hybrid, or study the genetic affinity of the parental material through detailed examination of chromosome pairing in the hybrid, or to evaluate the genetic barriers or genetic affinities through other genetic tests such as DNA homology, etc. As yet, little such data has come forward to evaluate the relationship between *G. darwinii* and *G. barbadense*, except for the study of Wendel & Percy (1990) just cited.

50. *Gossypium hirsutum* Linnaeus, Sp. pl. ed. ii. 975, 1763.

Gossypium barbadense var. *hirsutum* (Linnaeus) Triana & Planchon, Ann. Sci. Nat. Bot. ser. iv. 17: 171. 1862

(non *Gossypium barbadense* var. *hirsutum* Hooker & Benth, 1849).

Gossypium herbaceum var. *hirsutum* (Linnaeus) Masters in Hooker, Fl. Brit. India 1: 347. 1874.

Type: Miller's description (Gard. Dict. ed. vi. *Gossypium* sp. no. 4. 1752).

Numerous synonyms are cited by Fryxell (1979, 1988).

Shrubs 1-2 m (or more) tall, usually widely branching, more or less stellate-pubescent. Leaf blades mostly 4-10 cm long, cordate, weakly 3-5-lobed, the lobes broadly triangular to ovate, acute to acuminate, densely pubescent to glabrous, foliar nectaries present; petioles 1/2-1 times length of blade; stipules 0.5-1.5(-2) cm long, subulate or falcate. Flowers usually in sympodial inflorescences; pedicels 2-4 cm long, surmounted by 3 nectaries; bracts of the involucre 2-4.5 cm long, each inserted above a nectary, foliaceous (enclosing the bud), ovate, cordate, 3-19-laciniate, persistent; calyx 5-6 mm long (excluding teeth), truncate or 5-toothed; corolla cream-coloured or pale yellow, with or without a dark spot at base, the petals 2-5 cm long; staminal column (1-) 1-5 cm long; style more or less enclosed by androecium or somewhat exceeding it. Capsules 2-4 cm long, broadly ovoid or subglobose, 3-5-loculed, glabrous, smooth; seeds 1-10 mm long, several per locule, lanate, the seed hairs (cotton) white, tan, or red-brown.

Distribution: Wild forms occur in Middle America and in certain islands of the Pacific Ocean; the species is now found in cultivation in all cotton growing areas, as the world's dominant cotton crop.

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Type: Miller's description (Gard. Dict. ed. vi. *Gossypium* sp. no. 4. 1752).

Numerous synonyms are cited by Fryxell (1979, 1988).

Shrubs 1-2 m (or more) tall, usually widely branching, more or less stellate-pubescent. Leaf blades mostly 4-10 cm long, cordate, weakly 3-5-lobed, the lobes broadly triangular to ovate, acute to acuminate, densely pubescent to glabrous, foliar nectaries present; petioles 1/2-1 times length of blade; stipules 0.5-1.5(-2) cm long, subulate or falcate. Flowers usually in sympodial inflorescences; pedicels 2-4 cm long, surmounted by 3 nectaries; bracts of the involucre 2-4.5 cm long, each inserted above a nectary, foliaceous (enclosing the bud), ovate, cordate, 3-19-laciniate, persistent; calyx 5-6 mm long (excluding teeth), truncate or 5-toothed; corolla cream-coloured or pale yellow, with or without a dark spot at base, the petals 2-5 cm long; staminal column (1-) 1-5 cm long; style more or less enclosed by androecium or somewhat exceeding it. Capsules 2-4 cm long, broadly ovoid or subglobose, 3-5-loculed, glabrous, smooth; seeds 1-10 mm long, several per locule, lanate, the seed hairs (cotton) white, tan, or red-brown.

Distribution: Wild forms occur in Middle America and in certain islands of the Pacific Ocean; the species is now found in cultivation in all cotton growing areas, as the world's dominant cotton crop.

Illustrations: Watt (1907, figs. 27-33, 39-43); Valicek 1979, figs. 87, 88); Dariev & Abdullaev (1985, figs. 67, 68).

In previous studies (Fryxell 1979, 1984, 1988) I have treated *Gossypium lanceolatum* Todaro in specific rank, based on the suggestive data of Johnson (1975). I have maintained this view, in part, to challenge other workers to develop the kind of data that will resolve this long-standing question, since most workers have submerged *G. lanceolatum* in *G. hirsutum*, often treating it in infraspecific rank (see: Fryxell 1988) or as "race palmeri". Much of the recently acquired data has tended to favour the view that *G. lanceolatum* should be submerged in *G. hirsutum* as a distinctive type maintained only in cultivation.

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